Maternal Mortality in Guizhou Province and Xinjiang Uygur Autonomous Region, Western China

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ABSTRACT

Background The Chinese government has made great progress in improving maternal health, and in reducing maternal mortality ratio (MMR). Although the overall trend in maternal mortality in China is declining smoothly, there are still disparities between the eastern and western regions. Despite the global focus on maternal and child health (MCH) in China, the western China continues to lack systematic research data on maternal survival. Given that China's western provinces account for the largest burden of maternal deaths in the country, this thesis aims to address the following questions: What are the main causes of high maternal mortality in western China? Are there any disparities in maternal mortality within the western province? What are the determinants of these gaps? Have these gaps widened over time? Is there ethnic inequity? Despite being widely used for the estimation of MMR, the quality of surveillance data is often not well known.

Objectives To obtain retrospective data on maternal death and selected maternal and child health indicators for trends in maternal mortality in order to provide evidence for policy-making to decline MMR further in western China.

Materials and methods This thesis is based on two retrospective studies in China: 1) Xinjiang study, and 2) Guizhou household survey and Guizhou trends study. The Xinjiang study was carried out in 1997. Data were collected from 24 counties of the Xinjiang region that participated in a World Bank supported project on Maternal and Child Health. As no specific data were collected on maternal deaths in this study, we collected supplementary data on the reported deaths from the 1997 study (age, ethnicity and marital status) in 2005.

Guizhou household survey was conducted in Pingtang county and Honghuagang district of Guizhou province in 2008. All households in the selected areas were included. Of the total 5466 households 5459 were visited. The response rate was 99.9%. Guizhou trends study was a longitudinal retrospective study conducted in 2008 in Guizhou province. All 86 counties/districts of Guizhou province were included. The study period was from 1996 to 2007.

The Statistical Package for Social Sciences (SPSS) version 13.0, 15.0 & 17.0 were used to conduct frequency analysis, bivariate analysis, comparative analysis and multiple linear regression analysis to determine the associated factors for high maternal mortality and ethnic differences in trends of maternal mortality.

Results Xinjiang study identified 339 maternal deaths in 1997. 86.7% of these belonged to ethnic minority groups. The MMR in study areas of Xinjiang was as high as 534.2 per 100,000 live births. Postpartum hemorrhage (42.4%), internal complications (13.9%), pregnancy-induced hypertension (13.6%) and puerperal infection (9.2%) were the main causes of maternal deaths. MMR was negatively correlated with annual net per capita income ($r=-0.350$, $p<0.05$) and annual per capita income of farmers ($r=-0.427$, $p<0.05$) in study areas of Xinjiang. MMR was strongly correlated with average number of village doctors in study areas of Xinjiang ($r=0.799$, $p<0.001$). Multiple linear regression results showed that the determinants of MMR were average number of village doctors ($p<0.001$), proportion of villages without doctors ($p=0.001$), and the percentage of minority groups ($p=0.006$). [Paper I]

Compared with Pintang county (rural area), Honghuagang district (urban area) had a larger population but fewer deaths. There was difference in the number of live births between the survey data and routine data in both rural area (68 vs. 94) and

urban area (106 vs. 96). We found one missing maternal death in rural area, four missing child deaths in two study areas (2 in rural and 2 in urban area), three of which were neonatal deaths. Most of the health intervention coverage indicators were over-reported in both rural and urban routine data. No large gaps were found between the routine data and survey data from Guizhou province. However, the quality of routine data in urban area was better than rural in general. [Paper II]

A declining trend in maternal mortality and rising trend in hospital delivery in Guizhou province was observed in both minority and non-minority counties group. Ethnic differences between the two groups persist. Increased gross domestic product between 1996 and 2007 ($p < 0.001$), male illiteracy rate ($p=0.023$), and increased hospital delivery rate between 2002-2007 and 1996-2001 ($p=0.043$) were determinants for the reduction in maternal mortality. [Paper III]

Conclusion Maternal and child mortality surveillance (MCMS) system is designed to monitor maternal and child mortality as well as causes of death. MCMS data are used to adjust maternal and child mortality rates in China. The situation in Guizhou might reflect the situation in most provinces of China, if the findings are representative of the situation in the whole China, we can infer that China's MCH routine reporting system is in place and functional. However, more studies are needed to confirm this.

We found ethnic differences in maternal mortality and health services utilization. Although maternal mortality is declining in Guizhou, ethnic differences continue to persist with regards to MMR. Declining trends are associated with economic development, hospital delivery and male illiteracy. Ethnicity, economy, health resources and education should be taken into consideration when planning effective measures against preventable cases in western areas. Equitable economic

development is fundamental to the improvement of health. It is important to encourage ethnic minority women to improve their self-care awareness and protect themselves from the impact of social and cultural factors. There is a great need for effective health education on maternal health as well as basic education within ethnic minority groups in western China. Additionally, there are needs for more research of maternal mortality on ethnic minorities residing in multicultural areas.

LIST OF PAPERS

I Du Q, Næss Ø, Bergsjo P, Kumar BN. Determinants for high maternal mortality in multiethnic populations in western China. *Health Care for Women International* 2009; 30(11):957-70.

II Du Q, Næss Ø, Bjertness E, Yang GH, Wang LH, Kumar BN. Differences in reporting of maternal and child health indicators: A comparison between routine and survey data in Guizhou Province, China. *International Journal of Women's Health* 2012; 4:295-303.

III Du Q, Lian W, Næss Ø, Bjertness E, Kumar BN. The trends in maternal mortality between 1996 and 2007 in Guizhou, China: ethnic differences and associated factors. (submitted)

ABBREVIATION

CNY	Chinese Yuan
CI	Confidence Interval
DALYs	Disability-adjusted Life Years
GDP	Gross Domestic Product
HDR	Hospital Delivery Rate
ICD	International Classification of Diseases
IMR	Infant Mortality Rate
MCH	Maternal and Child Health
MCMS	Maternal and Child Mortality Surveillance
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
MOH	Ministry of Health
NCMS	New Cooperative Medical Scheme
OR	Odds Ratio
PHB	Provincial Health Bureau
PHC	Primary Health Care
PIH	Pregnancy Induced Hypertension
U5MR	Under-five Mortality Rate
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
USD	US Dollar
WHO	World Health Organization

1. Introduction

1.1 Global burden of maternal mortality

The Tenth Revision of the International Classification of Diseases (ICD) defines a maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental causes.[1] The maternal mortality ratio (MMR) is the number of maternal deaths during a given time period per 100,000 live births during that same time period.[2]

Globally, the estimated number of maternal deaths in 2005 was 536 000. Developing countries accounted for 99% (533 000) of these deaths. A little over half of these maternal deaths (270 000) occurred in the sub-Saharan Africa region alone, followed by South Asia (188 000). Collectively, sub-Saharan Africa and South Asia accounted for 85% of all maternal deaths globally. The adult lifetime risk of maternal death (the probability that a 15-year-old female will die eventually from a maternal cause) is highest in Africa (at 1 in 26), followed by Oceania (1 in 62) and Asia (1 in 120), while the developed regions have the smallest lifetime risk (1 in 7300).[3]

AboZahr reported that 73% of all maternal deaths occurred as a result of major obstetric complications. Post-partum hemorrhage continues to be a major cause of maternal death both in developing and developed countries.[4] Disability-adjusted life years (DALYs), calculated as the sum of years of life lost and years of life lived with disability, was developed specifically to estimate global burden of disease. Maternal health causes accounted for 0.6% DALYs in developed countries, and 2.4% in

developing countries. Sub-Saharan Africa had highest maternal-health related DALYs with 2.7%, followed by Asia with 2.2%.[5-7] Maternal disability is estimated to affect 20 million women a year.[8]

Maternal death does not only concern the mothers but also their families, communities and nations.[9] The complications that lead to maternal morbidity and mortality may also affect their offspring.[10,11] Each year, 4 million neonatal deaths occur worldwide. 99% of these deaths occur in developing countries. South Asia and sub-Saharan Africa account for two-thirds of the global disease burden in maternal and child health.[12]

Alongside being an indicator of maternal and neonatal wellbeing, maternal mortality is also an indicator of access, integrity and the effectiveness of a given health sector. Global campaigns focusing on the reduction of maternal mortality, such as the United Nations' fifth Millennium Development Goal (MDG), call for a reduction in maternal mortality by three-quarters between 1990 and 2015.[13]

1.2 Regional burden of maternal mortality in Asia

Southern Asia has the highest MMR in Asian regions. Eastern Asia has the lowest MMR. In 2008, Southern Asia had an MMR of 280 per 100,000 live births, whereas Eastern Asia had an MMR of 41 per 100,000 live births. Figure 1 shows the maternal mortality of Asian regions in 1990 and 2008.[14]

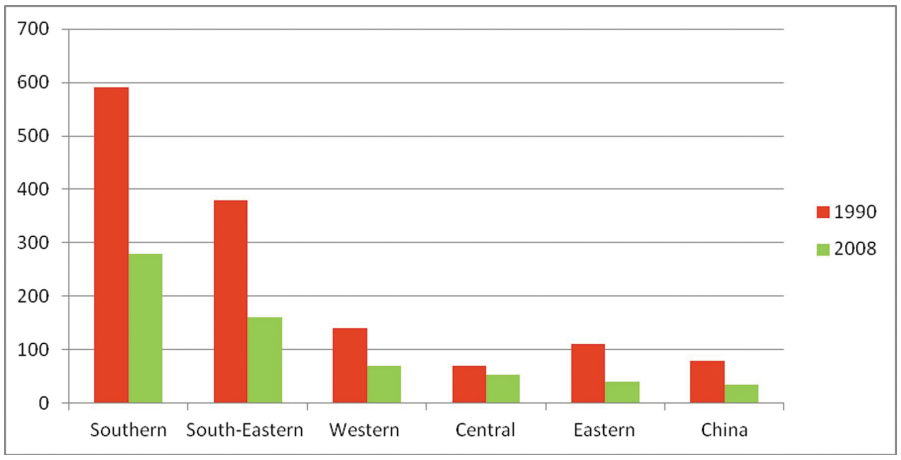

Figure 1. MMR (per 100,000 live births) in Asian regions 1990 and 2008

Although the MMR has been declining steadily from 1990, maternal mortality remains a major burden in Asian countries. MMR in Eastern Asia in 2008 declined by 62.7% compared to 1990, whereas it in Central Asia only declined by 22.9%. China is located in Eastern Asia and its MMR (34 per 100,000 live births) was lower than the average level of Eastern Asia. However, the rate of decline (57.5%) in China was lower than the average level of Eastern Asia. Compared to the requirements set out by MDG 5, most of Asian countries need greater progress and breakthroughs in the remaining years to 2015 to achieve the set targets.

1.3 Maternal mortality in China

China has the largest population in the world. With over 10,000 women dying from maternal causes annually, maternal deaths in China accounted for approximately 4% of the world's total.[9] The conference "Tracking Progress in Child Survival: Countdown to 2015" co-sponsored by United Nations Children's Fund (UNICEF), World Health Organization (WHO) and other institutions reviewed the attainment of

MDG4 and MDG5 in various countries in London in December 2005. China was categorized as one of the 60 "countdown" countries prioritized to attain MDGs.[15]

China has made progress in reducing maternal mortality in the past years, and as a result, the MMR has been reduced from a baseline of 80.0 maternal deaths per 100,000 live births in 1991 to 36.6 per 100,000 in 2007, a decline of 54.3%.[16] Although the overall trend of maternal mortality in China is declining steadily, there are still wide disparities across China. These disparities can be observed in certain parts of the country and society, and are dependent on the socioeconomic status, urban-rural residence and geographic location. Figure 2 shows the geographic distribution of maternal mortality in 2007.

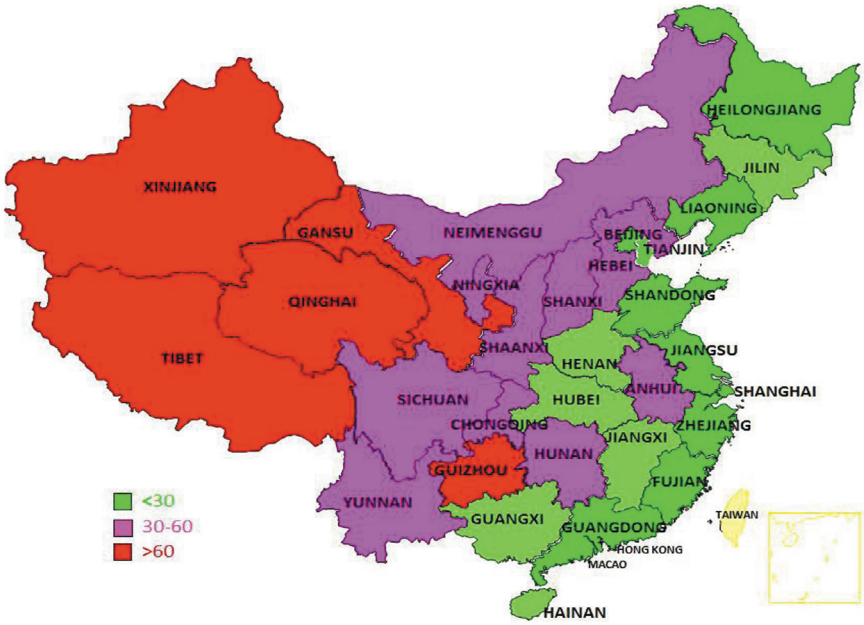

Figure 2. Map of China showing geographic distribution of MMR (per 100,000 live births) in 2007

Western China has the greatest MMR in China, which was 2.6 times greater than Eastern region, and 1.7 times greater than Central region. The western areas represent 26.1% of total live births in China but account for 44.2% of total number of maternal deaths in the whole country.[17] Obstetric hemorrhage, amniotic fluid embolism and pregnancy-induced hypertension (PIH) are the main causes of maternal mortality in China.[16]

1.4 The determinants and contributing factors of maternal mortality

The Safe Motherhood Initiative was launched globally in 1987 in Nairobi, and had four pillars.[18] See Figure 3.

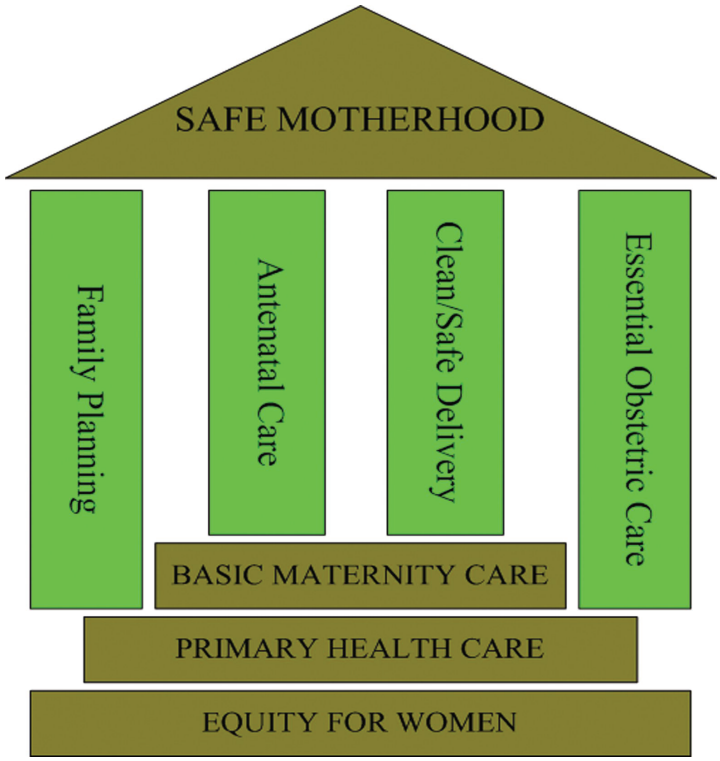

Figure 3. Four pillars of the Safe Motherhood

Family planning. In some developing countries, unsafe abortion practices account for almost half of all maternal deaths.[19] Integration of family planning within the maternal health programs have yielded positive results in some developing countries.[20]

Antenatal care. Antenatal care cannot be expected to have a significant impact on maternal mortality alone but can help reduce maternal mortality.[21,22]

Clean/safe delivery by the skilled attendant. The value of skilled attendants in lowering MMR has been shown in both developed countries and developing countries.[23]

Essential obstetric care. The majority of maternal deaths could be avoided by access to basic obstetric care.[24] Low standard of care for obstetric referrals was identified as a contributing factor to maternal deaths.[25]

Contributing factors of maternal mortality

Socio-economic factors. Maternal health is intertwined with the poor status of women in society and with economic inequity.[26] Low socio-economic background has a significant influence on maternal mortality.[27-31] Moreover, lower maternal socio-economic status is thought to increase risk for perinatal death.[32]

Socio-demographic factors. Ethnic/racial minority groups are considered to be at a greater risk of maternal mortality compared to women belonging to the majority population.[32-36]

Health resources and access to health services. High level of maternal mortality

in developing countries has partly been attributed to the non-availability of services, and partly to poor utilization of services even when they are available.[37] Poor education and multiparity increase the risk of home delivery.[38]

Reproductive behavior factors. Reproductive behaviors, such as age of the mother, number of pregnancies and pregnancy interval are also risk factors for maternal death.[39]

Health status factors. Nutritional status is a factor that may increase the risk of pregnancy-related deaths in developing countries. However, the contribution of nutrition has not been addressed systematically.[40]

Figure 4 shows "three delays theory" and related factors for maternal death.[41,42]

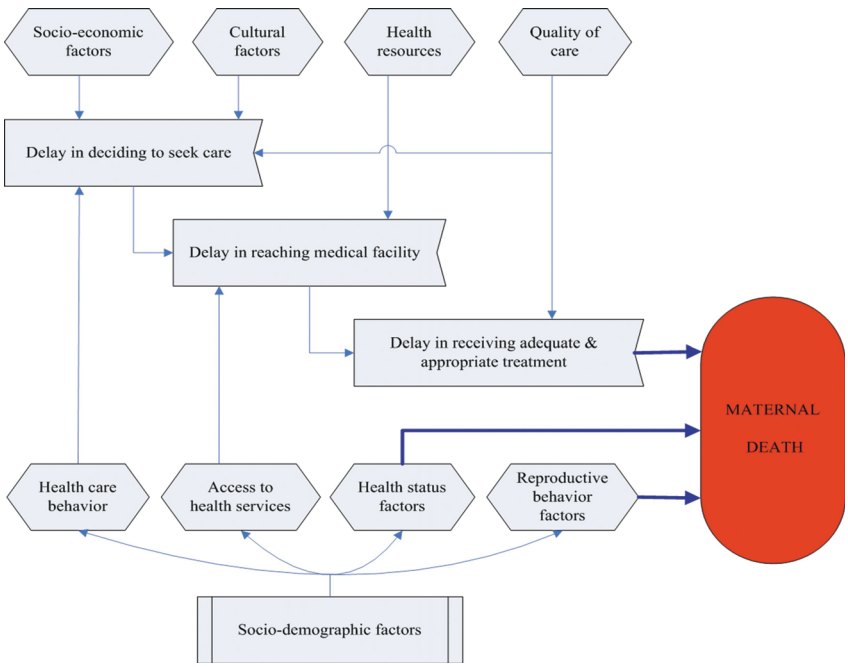

Figure 4. Three delays theory and related factors for maternal death

1.5 Health administration

China spans over 9.6 million km^2. Administratively, the whole country is divided into 22 provinces, 5 autonomous regions and 4 metropolitan municipalities under the central government, exclusive of Hong Kong, Macao and Taiwan. The provinces, which possess a high degree of fiscal independence, are themselves divided into prefectures, counties, townships and villages. Figure 5 shows Chinese administration and health care system.

China implemented the Primary Health Care (PHC) system from 1990 and established a three-tier health care delivery system. These three levels are:

- ✧ The primary level is the Village Health Clinic, which provides basic health care services, including health education and postnatal care.
- ✧ The secondary level is the Township Hospital, which provides preventive, curative, outpatient and inpatient services. Many of these hospitals are responsible for delivering babies.
- ✧ The tertiary level is the County Hospital, which provides all health services, including specialist care services.

The primary level has its roots in the village barefoot doctor system from the Maoist period in 1970s. The barefoot doctor system was cleared away in mid 1980s after the collapse of the collective economy. Village doctors then worked on contract basis at the village health clinics. Village doctors relied on selling medicines to earn their living and as a means of survival. As a result, rural healthcare system within China took a hit and lagged behind. The Health Care Reform of 2000 changed the nature of rural healthcare by integrating the state-funded primary healthcare services

within the health structure.

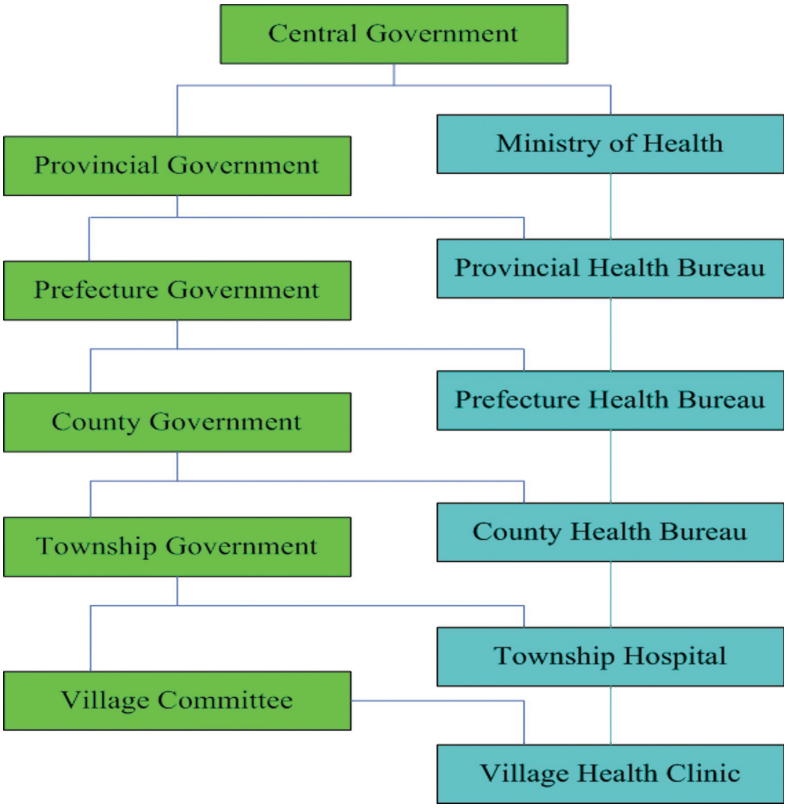

Figure 5. Chinese administration and health system

China is geographically divided into eastern, central and western regions. The eastern region includes 11 provinces: Beijing (BJ), Tianjin (TJ), Hebei, Liaoning (LN), Shanghai (SH), Jiangsu (JS), Zhejiang (ZJ), Fujian (FJ), Shandong (SD), Guangdong (GD) and Hainan. The central region includes 8 provinces: Shanxi, Jilin (JL), Heilongjiang (HLJ), Anhui (AH), Jiangxi (JX), Henan, Hubei and Hunan. The western region includes 12 provinces: Shaanxi, Chongqing (CQ), Sichuan (SC), Gansu (GS), Neimenggu (NMG), Ningxia (NX), Yunnan (YN), Guizhou (GZ), Guangxi (GX), Qinghai (QH), Xinjiang (XJ) and Tibet.

The Information and Statistics Center of the Ministry of Health (MOH) classifies all Chinese cities and counties into six stratifications (two urban and four rural) according to their socio-economic development status. These classifications are based on a range of indicators, such as gross domestic product (GDP) per capita; population size, educational achievement and illiteracy rate, employment rate, crude birth and death rates, and infant mortality rate.[43] Cities are categorized according to their size. Bigger cities are classed as 'large' city and smaller cities as 'medium/small'. Rural counties are categorized into types I, II, III and IV, with type I being the most developed rural county and type IV the least developed. Figure 6 shows a map of China that is labeled in color to show the rural and urban districts and counties.

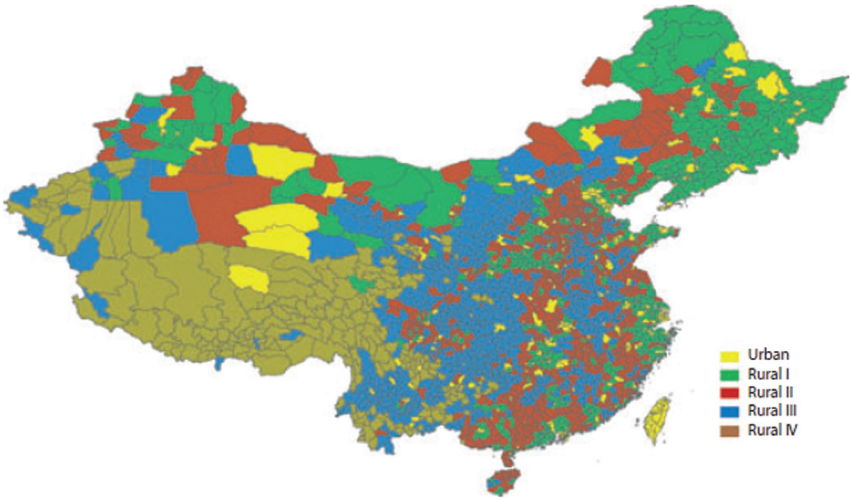

Figure 6. Urban and rural districts and counties in China

1.6 Economic development in China

In the context of Chinese economic reform and opening up for foreign exchange over the last 30 years, Chinese government has worked continuously towards economic

development. In 2007, China's GDP was 24953 billion Chinese yuan (CNY), which is equivalent to 3283 billion US dollar (USD, 1 USD = 7.6 CNY). GDP per capita was 2491 USD. However, this economic development has not been uniform throughout the country, and there are considerable differences between eastern, central and western China. In 2007, the GDP per capita in the eastern region, central and western regions were 4152 USD, 2025 USD and 1735 USD respectively.[44] Figure 7 shows the composition of China's GDP by geographic location.

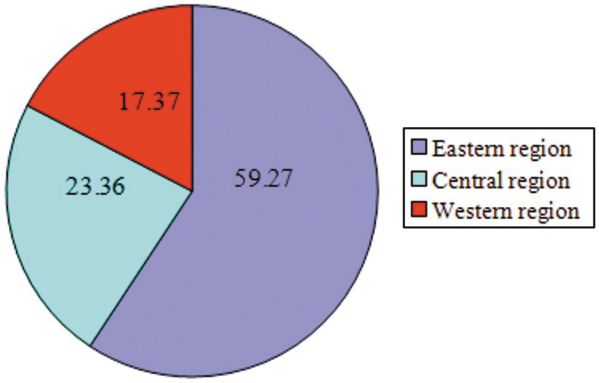

Figure 7. The composition (%) of China's GDP in 2007

China is still in the middle stage of urbanization. The transfer acceleration of rural labor and rapid economic development have led to migration from rural to urban areas, especially from poorer western region. The migrant population has made a huge contribution towards urban economy, with Chinese cities becoming central to economic development and growth in China.

1.7 China's population and family planning

China has a total of 56 ethnic groups. Hanzu is the biggest ethnic group in China. According to 2010 Chinese sixth census data,[45] the population of China has reached about 1.34 billion, with rural areas comprising 50.3% of the population. By 2010, approximately 221.4 million individuals have migrated from rural areas to urban cities. This represents an 82.9% increase in migration compared with the 5th census, which was undertaken in 2000. In 2010, Hanzu Chinese accounted for 91.6 % of the total population. Ethnic minority groups mainly reside in the western region, in places such as Xinjiang, Tibet, Guizhou, Guangxi and Yunnan. Ethnic minorities comprise 21.5% of the population in the western region. Figure 8 shows the percentage of ethnic minority groups by province.

Since 1980, China's family planning policy restricts the number of children per family. According to this policy, Hanzu couples in urban areas can only have one child. Rural Hanzu couples can have two children with an interval period of 4 years between the first and the second child provided that the first child is a female. Ethnic minorities are permitted two children if they reside in urban areas and three children if they reside in pastoral areas.[46] Violation of family planning policies results in heavy fines and may cost the parents their jobs.[47] To avoid being penalized, non-compliant families opt for home-births. As a result, many home-births and deaths go unreported within the routine reporting system.[10]

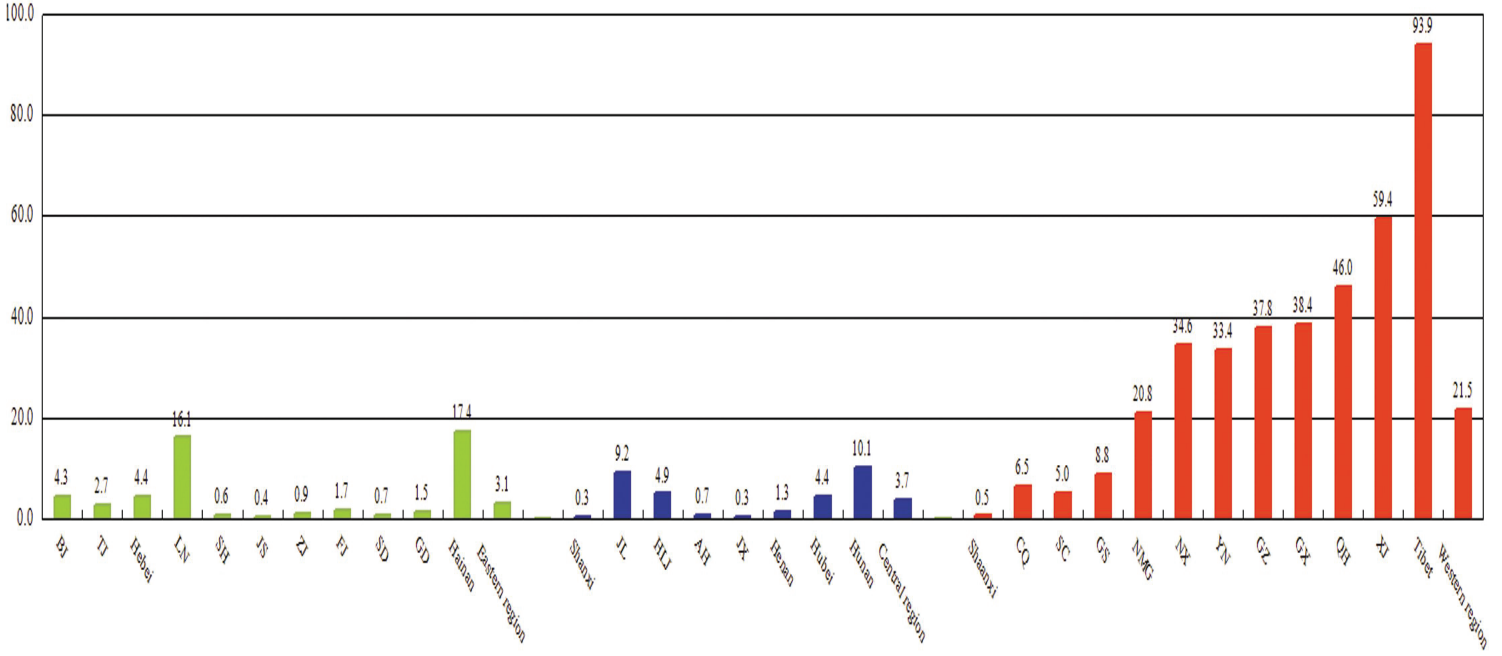

Figure 8. The percentage of ethnic minorities (%) by province in China

1.8 Health improvement

The development of a given health enterprise is not only restricted by the level of financial investment but also by the development of a country's economy.[48] Thirty years have elapsed since China changed its fiscal policies. Changes in policies have resulted in the betterment of health on a global level in China. In 2006, 4.7% of the Chinese GDP (approximately 129.5 billion USD) was used in health expenditure costs. Urban areas accounted for 66.9% of this expenditure. Per capita health expenditure in urban areas was 2.6 times higher than in rural areas. Corresponding health expenditure in 1996 was 35.7 billion USD.[49]

The Chinese government has worked continuously to improve maternal and child health (MCH) through legislation, clarifying the function and management of the MCH service network, implementing international cooperation MCH projects. All of these projects have helped improve the health status of Chinese women and children steadily. China now has over 3000 MCH centers nationwide that employ 500,000 individuals in a three-tiered network of county, township and village level services providing MCH care services to the entire country.[44] Each level of health facility has established prompt and effective healthcare and a "green channel" system to eliminate maternal and infant death due to delayed referral or first-aid.

Several cooperative projects with international organizations such as the WHO, UNICEF, United Nations Population Fund (UNFPA) and World Bank have improved quality of services and reduced MMR in the poorer central and western regions. Additionally, the Chinese government has organized and implemented the "Reducing Maternal Mortality Rate and Elimination of Neonatal Tetanus" Program, allocating over 200 million USD for this program between 2000 and 2008. The MOH also launched a policy for subsidizing hospital delivery within rural areas to promote safer deliveries. This program has included setting a fixed price for hospital delivery in central and western regions. On average, the fixed price for a normal hospital delivery

is 600 CNY at the township level hospital and 1000 CNY at the county level hospital. The national hospital delivery promotion program in rural areas proposes that a pregnant woman will receive 400 CNY if she delivers in a hospital close to where she lives.

The Chinese government also implemented the New Cooperative Medical Scheme (NCMS) in 2003, which anticipated covering the entire rural population by 2010. A system of medical financial aid to fund and subsidize the poor to participate in NCMS has also been introduced. The central government funds a 5 USD subsidy to members of the NCMS in central and western regions. Alongside this, local government provides a further minimum sum of 5 USD to each person who joins the Scheme. The rural pregnant women who deliver babies in hospital can also get 200 CNY from the NCMS within her area of domicile.

All of the above inputs have ensured the improvement of maternal health in China. As a result, MMR decreased from 80.0 to 31.9 per 100,000 live births in 2009, and hospital delivery rate (HDR) increased to 96.3% in 2009.[50] Figure 9 shows the trends in maternal mortality in China from 1991 to 2009.

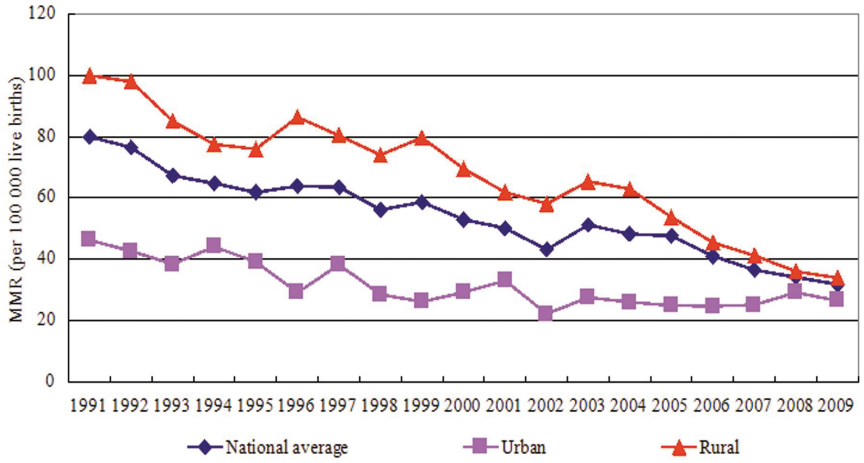

Figure 9. The trends in maternal mortality in China 1991-2009

1.9 Health inequality

Although China has achieved good improvement in overall health status within the past 30 years, socio-economic development has not been uniform throughout the country. This has led to disparities within uptake of health services as well as health development from urban to rural areas in eastern, central and western regions. Figure 9 shows the differences in maternal mortality between urban and rural areas in China. Figure 10 shows geographic disparities in maternal mortality in China.[50] Imbalances within health resources allocation have increased these gaps. These gaps are a result of disparities in the distribution of health resources and the number of health care practitioners between cities and rural counties in the eastern, central and western regions in China.[44,49] These gaps continue to grow. Eighty percent of the health resources are allocated to urban areas. The rural areas of China, which make up 70% of the total population, are served by only 37.5% of qualified health workers.[51] Figure 11 shows the number of beds and health personnel per 1000 population in China.

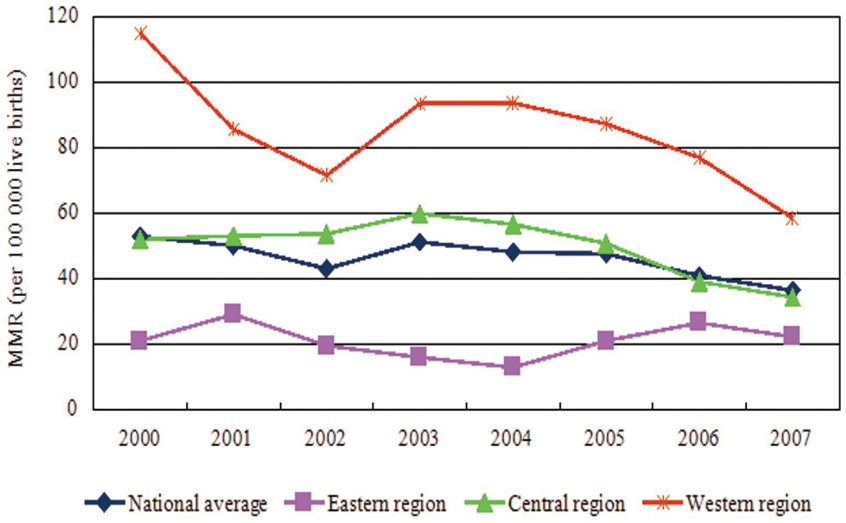

Figure 10. The geographic disparities in maternal mortality in China

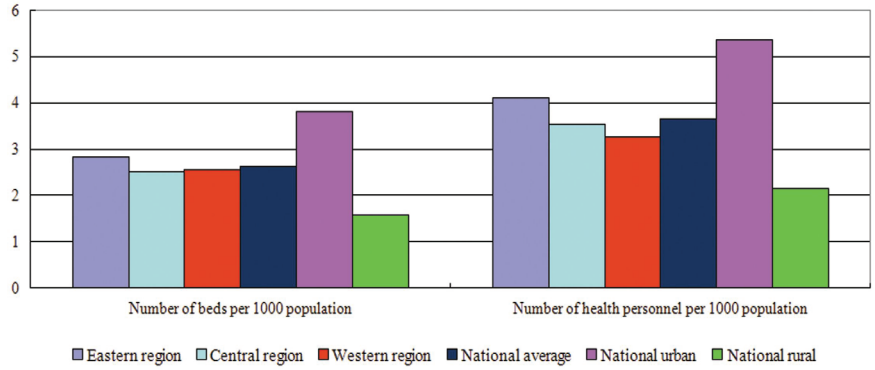

Figure 11. Number of beds and health personnel per 1000 population in China 2007

1.10 MCH information system

The current MCH indicators in China come from routine reporting data sources. Figure 12 shows the structure of Maternal and Child Health Reporting System in China.[52] The MOH estimates the mortality at national level and the coverage of health interventions based on these routine data.

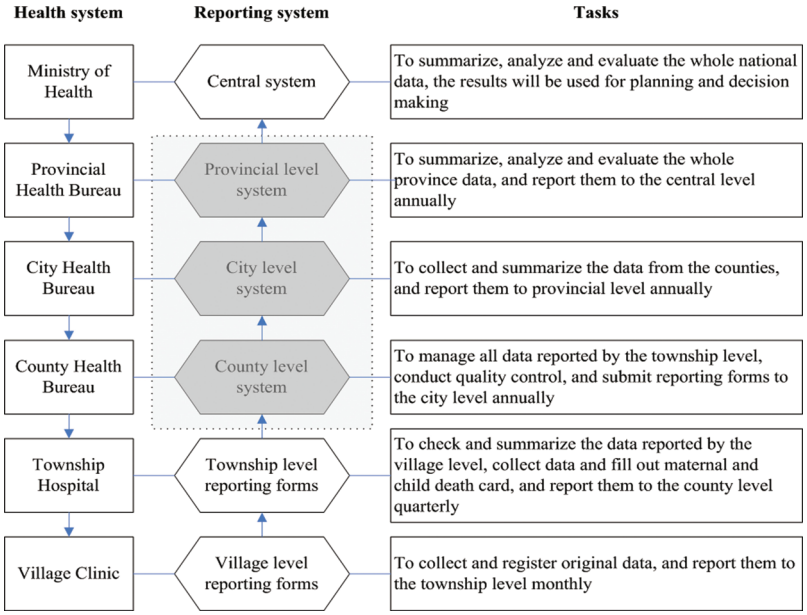

Figure 12. The structure of Maternal and Child Health Reporting System in China

The Ministry of Health and the National Bureau of Statistics are responsible for developing reporting forms for MCH indicators in China. These reports are considered to be statutory reports. Every county and district within the 31 provinces (autonomous regions and municipalities) in mainland China are, therefore, obliged to fill out these forms.[53]

China established a national maternal mortality surveillance system in 1989. Initially, this program covered 247 maternal mortality surveillance sites and a population of 100 million individuals. This was approximately 8 percent of the total population in China at the time. National child mortality surveillance system was established in 1991. This program initially covered 81 surveillance sites and a population of 8.5 million. The birth defect surveillance program was established in 1986, and was a hospital-based surveillance system. In 1996, the MOH incorporated maternal mortality surveillance, child mortality surveillance and birth defect surveillance into national Maternal and Child Mortality Surveillance System (MCMS). The number of surveillance sites has been expanded from 116 in 1996 to 336 as of today, with 126 of these being in urban areas and 210 in rural areas.[50] A MCH institution at each surveillance site is responsible for filling in a death report card in the field after receiving notification of deaths from the MCH doctors. MCMS reports the number of live births, the number and causes of maternal and child deaths, and provides scientific evidence for health officials and MCH workers through data analysis and utilization.

The MOH has carried out national health services surveys every 5 years since 1993 (excluding Hong Kong, Macau and Taiwan) to provide data for health planning. The MCH is part of this survey, and MCH indicators such as MMR, infant mortality rate (IMR), hospital delivery rate, and antenatal care coverage are reported. Additionally, a few international cooperation projects conduct baseline and endline surveys to evaluate the effect of MCH interventions.[54] MMR, IMR and under-five mortality rate (U5MR) are common indicators that used to monitor both the health

status of a country or region, as well as the region's progress towards the achievement of MDG 4 and 5.[2,9,10] MCMS is assumed to be the most reliable data source for the estimation of maternal and child mortality in China.

1.11 Scientific contribution

Although China has received global attention with regards to strengthening its MCH indicators, there is still lack of systematic research and data on the actual situation of maternal survival in western China. Given that western provinces account for the largest burden of maternal deaths in China, little is known as to why this is the case. Maternal health data show that there are large disparities between the eastern and western regions. However, little is known as to whether there are disparities within the various counties of western region with regards to maternal mortality. Little is known as to the determining factors of maternal health gaps and whether these gaps have widened over time. Despite being widely used for the estimation of MMR, IMR and U5MR, the quality of surveillance data is often not well known.[55,56] This thesis aimed to synthesize the varying levels of evidence to answer the aforementioned questions.

Although ethnic minorities only comprise 8.5% of the total Chinese population, the total number of ethnic minorities is well over 100 million due to China being the most populous country in the world. Approximately 2/3 of these reside in the western region, with 73.5% living in Xinjiang Uygur autonomous region (Xinjiang region), Guangxi Zhuang autonomous region (Guangxi region), Guizhou province and Yunnan province.[45] So far, only a few studies have looked at the underlying causes for maternal mortality from the perspective of ethnic minority groups. This study focused on multi-ethnic populations in the western region in investigating the associated factors related to MMR as well as differences between minority and majority groups.

It is important to acquire accurate and reliable reporting data for maternal and child mortality in designing policies that encompass all Chinese women and children's health issues. This is especially the case with regards to counting the

number of deaths occurring outside the health care system due to incomplete death registration systems. To our knowledge, this is the first internationally published study from China that compares key maternal and child health indicators from the routine reporting data with the surveyed data.

This study analyzed the trends in maternal mortality in the Guizhou province between 1996 and 2007. The findings from this study raise awareness about the gap to achieve MDG 5 in western China. They provide evidence that can be used to address the issues related to the "missing" maternal deaths, and hopefully contribute to designing more effective strategies for reducing maternal mortality even further in western China.

2. Objectives

The aim of this study is to obtain retrospective data on maternal deaths and selected MCH indicators for trends in maternal mortality in order to provide evidence for policy-making to decline MMR further in western China.

Research Questions

- What are the underlying causes of high maternal mortality in western China? Are there any ethnic differences in maternal mortality?
- What is the quality of MCMS data? Can the data be used for estimating the rate of maternal and child mortality?
- Does maternal mortality follow a certain trend in Guizhou province, and if so, what factors are associated with these trends? Are there any differences between minority counties and non-minority counties?

Specific Objectives

- To investigate determinants and patterns of associations with high maternal mortality in poor and multi-ethnic populations of Xinjiang Uygur autonomous region of western China. [Paper I]
- To compare maternal and child mortality as well as other selected maternal and child health indicators between routine data and survey data in Guizhou province. [Paper II]
- To study the trends in maternal mortality and factors associated with it in Guizhou province between 1996 and 2007, and to examine any potential differences between minority counties and non-minority counties in Guizhou province. [Paper III]

3. Methods

3.1 Study area

The study was carried out in two western areas of China – Guizhou province and Xinjiang region.

3.1.1 Geography

Guizhou province is a mountainous province located in southwest China, comprising 1.8% of the country's geographical area. Guizhou province is divided into 9 prefectures, where 3 of the prefectures are ethnic autonomous prefectures. Guiyang is the capital city. In 2009, this province included 88 counties and 1555 townships.[57]

Xinjiang region lies in northwest China, encompassing 1/6 of the country's area. This region borders with 8 countries: Mongolia, Kirghizia, Russia, Kazakstan, Krygyzstan, Afghanistan, Pakistan and India. Xinjiang region is divided into 14 prefectures and the capital city is Urumuqi. In 2009, this region comprised 98 counties and 1005 townships in total.[57]

Figure 13 shows the maps of Guizhou province and Xinjiang region.

Guizhou Province Xinjiang Region

Figure 13. Maps of Guizhou and Xinjiang showing the prefectures

3.1.2 Demographic characteristics

The total population of Guizhou province is 34.75 million. Approximately 70.1% of the residents live in rural areas. The population density is about 197 person/km^2. In 2009, the birth rate for this province was 13.7‰, death rate was 6.7‰ and natural growth rate was 7.0‰. All 55 ethnic minority groups can be found in Guizhou province. The main minority groups are 'Miao', 'Buyi', 'Dong' and 'Tujia'. The sixth population census in 2010 showed that ethnic minority groups accounted for 35.7% of total population in Guizhou.[45,57]

The total population of Xinjiang region is 21.82 million, with 60.2% of the residents living in rural areas. The population density is about 13 person/km^2. In 2009, birth rate for Xinjiang region was 16.0‰, death rate was 5.4‰ and natural growth rate was 10.6‰. There are 46 ethnic minority groups. The main minority groups are 'Uygur', 'Kazak', 'Hui' and 'Mongol'. The sixth population census in 2010 showed that ethnic minority groups accounted for 59.5% of total population in Xinjiang.[45,57]

3.1.3 Economy

Guizhou province has a GDP of 391.3 billion CNY (51.5 billion USD) in 2009. GDP per capita was 10,309 CNY (1356 USD). In the same year, GDP for Xinjiang region was 427.7 billion CNY (56.3 billion USD), and GDP per capita was 19,942 CNY (2624 USD).[57]

3.1.4 Education

Nine years of primary education is compulsory in China, and most of the schools are public schools. In 2009, there were 451 senior high schools, 47 colleges and universities in the Guizhou province. The illiteracy rate was 11.4%. Xinjiang region had 413 senior high schools, 37 colleges and universities. The illiteracy rate was 3.0%.[45,57]

3.1.5 Culture

There were 93 public libraries in Guizhou province in 2009. Guizhou had published 31 kinds of newspapers, 89 kinds of magazines and 943 kinds of books in one year. In 2009, Guizhou had 24 sets of public radio programs and 100 sets of public television programs. Xinjiang region had 94 public libraries in 2009. Xinjiang had published 99 kinds of newspapers, 209 kinds of magazines and 7735 kinds of books in one year. There were 154 sets of public radio programs and 188 sets of public television programs in Xinjiang in 2009.[57]

3.1.6 Health service

In 2009, Guizhou province had 24,707 health institutions in total, out of which 88 were maternal and child health hospitals. These hospitals comprised 91,164 beds, which is approximately 2.2 beds per 1000 population. The province had 96,753 registered health workers in 2009, which results in 2.4 health personnel per 1000 population.[57]

There were 14,244 health institutions in Xinjiang region in 2009, out of which 90 were maternal and child health hospitals. Xinjiang had 102,620 hospital beds, which comes to 4.8 beds per 1000 population. There were 116,028 registered skilled health personnel, which results in 5.5 health workers per 1000 population.[57]

3.2 Study design and setting

A quantitative, retrospective study (Xinjiang study) was carried out in 1997 among the 24 counties of Xinjiang region. This study was part of the Maternal and Child Health Project (Health IX project) supported by the World Bank. As there were no individual data on maternal deaths in the 1997 study, supplementary data were collected for individual information on the same deaths in 1997. We collected data on the age, ethnicity and marital status of the deceased individual in all of the counties in 2005. The study used the existing data and new collecting data to identify the key determinants and associated factors of maternal mortality in the study areas of Xinjiang. Three delays theory and related factors for maternal death was used as the

framework. This study focused on socio-economic, socio-demographic, health service resources and health services utilization factors in the conceptual framework.[41,42]

The 24 study counties in Xinjiang region were selected through the criteria established by the MOH, which are based on the national policy for reduction of maternal mortality in poor areas. The first criterion was that MMR from routine reporting system should be higher than the average of the provincial level. The second one was that the annual income per capita was under the average level for the province. A total of 96 counties in Xinjiang in 1997 were divided into two groups according to the first criterion: high and low MMR groups. Then, we selected 24 counties in the high MMR group with low annual income per capita. All 286 townships and about 70% of all villages (1954 villages) were selected in these 24 counties. Figure 14 shows the flowchart of sampling framework in Xinjiang region. [Paper I]

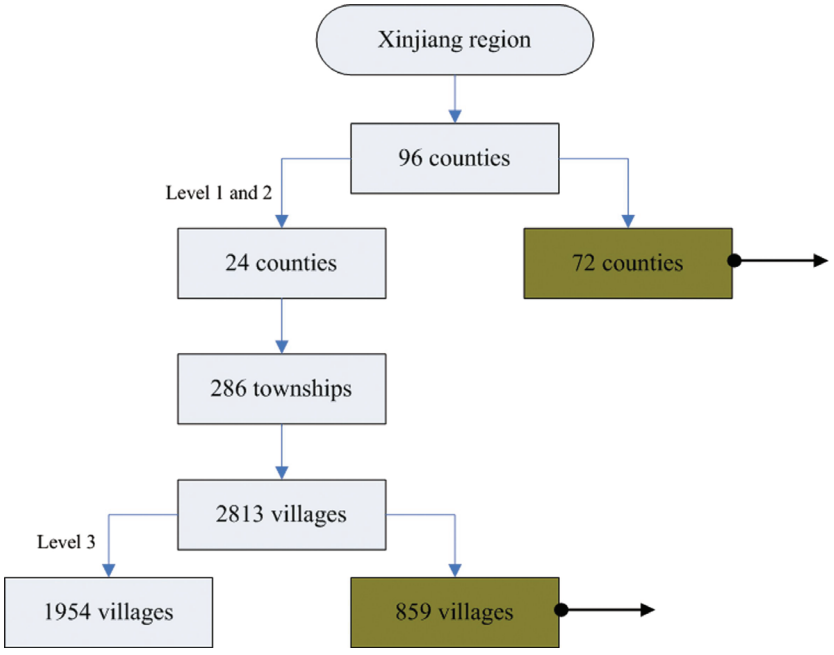

Figure 14. Flow chart of sampling framework in Xinjiang region

A retrospective study (Guizhou household survey) was conducted in two counties of the Guizhou province during April-November 2008. This study was designed to compare maternal and child mortality as well as other selected maternal and child health indicators between routine data and survey data. The two study counties in Guizhou were randomly selected. Honghuagang district was randomly selected as the sample urban area out of a possible 8 urban surveillance sites in Guizhou. Similarly, Pingtang county was chosen as the sample rural area out of a possible 18 rural surveillance sites in Guizhou. One street from Honghuagang and one township from Pingtang were once again randomly identified and every household within these areas was surveyed. Figure 15 shows the flowchart of sampling framework in Guizhou province. [Paper II]

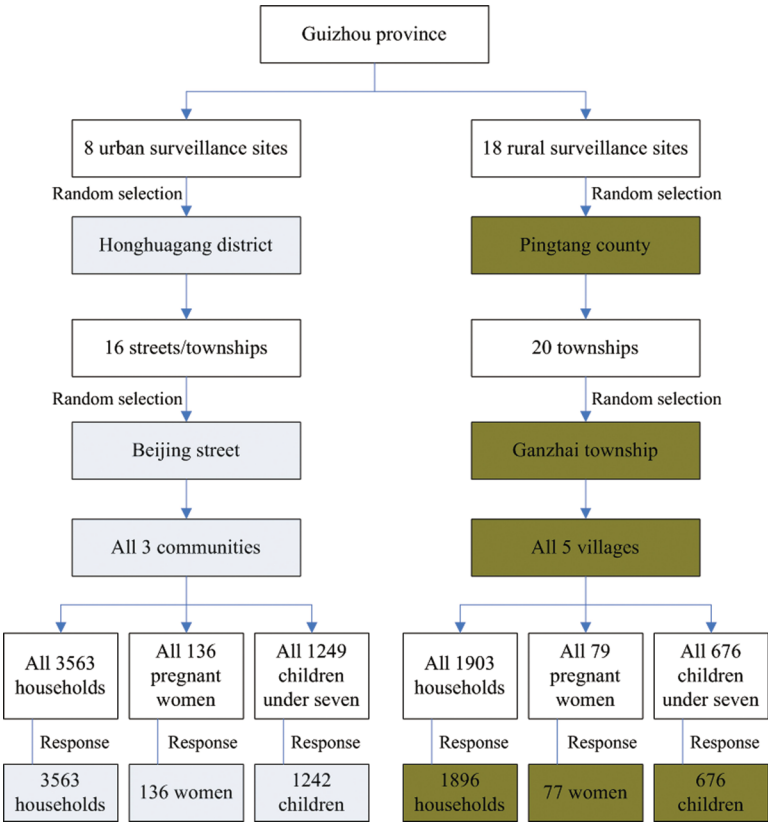

Figure 15. Flow chart of sampling framework in Guizhou province

A longitudinal, retrospective study (Guizhou trends study) on the trends in maternal mortality was conducted in Guizhou province. All 86 counties/districts of the province were included. The study period was from 1996 to 2007. [Paper III]

3.3 Study population

The study population in Xinjiang study was composed of women who were pregnant or had recently delivered their babies in 1997 and resided in the study areas of Xinjiang region, 63463 pregnant women in total were studied. Maternal death was identified according to the ICD-9 definition of the WHO. [Paper I]

The study population in Guizhou household survey was all households within selected township/street in Pingtang county and Honghuagang district. A total of 5459 households out of 5466 were visited in this household survey – 3563 in the urban area, 1896 in the rural area. [Paper II]

The Provincial Health Bureau (PHB) of Guizhou was interviewed to access to routine MCH reporting database including all 86 counties between 1996 and 2007 in Guizhou trends study. [Paper III]

3.4 Ethical approval

The Chinese Ministry of Health and the National Center for Women and Children's Health, Chinese Center for Disease Control and Prevention approved the study protocols. These studies were conducted in accordance with the ethical principles set by the World Medical Association Declaration of Helsinki. We obtained a written signed consent from everyone who participated in this study.

3.5 Data collection and analysis

3.5.1 Paper I

Determinants for High Maternal Mortality in Multi-ethnic Populations in

Western China

The MOH and the World Bank developed uniform questionnaires to collect data in the 1997 study. These questionnaires were first prepared in Chinese, and subsequently translated into Uygur in Xinjiang by local professional health workers. After data collection, all questionnaires in Uygur were translated back to Chinese. The differences in translation were discussed and corrected. As the existing data had no personal information about maternal deaths, an additional questionnaire was used to obtain this data in 2005.

We combined confidential enquiry and verbal autopsy for data collection. Confidential enquiry data were collected by questionnaires to the health bureaus and hospitals. We reviewed health records and documents in health facilities, looked at all available death certificates relating to maternal deaths, where we focused on utilization of health services and contributory causes of death. Verbal autopsy data were collected by a structured questionnaire to close relatives of the deceased women. The protocol advocated interviewing female respondents who had been in contact with the deceased women around the time of her death, such as the deceased individual's mother-in-law, sister and birth attendant. A trained health worker conducted interviews with the respondents in their homes. We asked the respondents about deceased woman's general health, reproductive history, health service utilization, the process of delivery, health seeking behavior and any treatment that she had received. Trained health workers were responsible for filling in questionnaires according to the information received from the health bureau and hospitals, health records and household interviews. The investigators would classify maternal deaths by the WHO ICD-9 definition.

We adopted cascade training for the data collection. Experts from the national level trained the provincial level personnel, while provincial trainers subsequently trained the personnel from county level, and finally county trainers trained local investigators under the guidance of provincial experts.

The study established a data quality control system for consistency, integrity and validity. After collecting original data, the investigators performed a repeat check themselves. As a measure of additional quality control on the data collected, investigators exchanged their collected material with another investigator who checked their data and vice versa. Additionally, trainers at provincial level made random inspection visits to counties to inspect the missing cases and correct errors of maternal deaths and live births. The national level trainers also did random inspection at the provincial level. Finally, all of the collected data were submitted to the MOH and re-checked at national level.

All statistical analyses were performed using SPSS 13.0. We used frequency analysis to obtain the descriptive statistics for individual data. We conducted bivariate analysis for the county data to investigate whether there was any correlation between MMR and independent variables. Multiple linear regression analysis was undertaken on data looking at factors associated with MMR at the county level and stepwise procedure was selected.

3.5.2 Paper II

Differences in reporting of maternal and child health indicators: A comparison between routine and survey data in Guizhou Province, China

The original local records of hard copies in the MCH routine data were obtained from the local Health Bureau in Pingtang and Honghuagang. Three original questionnaires covering the same MCH indicators with the routine data source were used to collect survey data during 1 October 2007 to 30 September 2008 (time period was consistent with routine data source) in study areas through household interview. Questions about socio-economic characteristics were also included. All questionnaires were in Mandarin Chinese. For 10% of the elderly respondents from ethnic minority backgrounds who could not understand Mandarin, local translators orally translated the questions into their native languages. The differences in translation were discussed

and corrected by the investigators.

We trained 24 MCH workers in study areas as investigators in rural and urban areas respectively on the contents of questionnaires, interpretation of each question, classification of maternal death and child death according to ICD-10, as well as skills for conducting the interview. The questionnaires were pre-tested with local investigators, problems were identified, and questionnaires were modified accordingly.

The investigators visited a household three times. If they could not find a respondent in the house on the third visit, the case was excluded. The respondents in our sample were mothers (46.0%), fathers (32.5%), grandmothers (11.1%), grandfathers (9.0%), and other caregivers (1.4%). We obtained a signed informed consent from each respondent prior to the interview. Data was collected during August – November 2008. The trained investigators were responsible for entering the answers. They also checked each other's forms for errors and completeness daily. Any questionnaires with omissions or queries were additionally investigated and corrected within a week. Alongside this, we checked all of the collected data at the end of each month. If we were in doubt about any particular aspect of the questionnaire, these were marked and sent back for correction. The survey results were then compared to the routine data obtained from the county and district health bureau.

We selected main MCH indicators from the routine data source for comparison between the routine data and survey data. These indicators included demographic data, nutritional data, maternal health, as well as newborn and child health. We selected socio-demographic and socio-economic indicators from our survey data for comparison between rural and urban areas. We calculated the selected MCH indicators with the same method used by the routine reporting system.

Statistical analyses were performed using SPSS 15.0. We conducted a frequency analysis to obtain descriptive statistics. Chi-square test was used for comparative

analysis.

3.5.3 Paper III

The trends in maternal mortality between 1996 and 2007 in Guizhou, China: ethnic differences and associated factors

Data was collected from the Maternal and Child Health Reporting System database from Guizhou PHB. These included live births, maternal deaths, causes of maternal deaths, and hospital deliveries in all 86 counties/districts of Guizhou province between 1996 and 2007. The data on GDP, GDP per capita and farmer net income per capita for each county/district between 1996 and 2007 were obtained from the Statistical Yearbooks of Guizhou province. Data on illiteracy rate and the proportion of ethnic minorities in each county/district were obtained from the Fifth National Census data in 2000.

According to the Fifth National Census data in 2000, ethnic minorities comprised 37.8% of the total population in Guizhou. Using this proportion as the cut-off, we categorized all 86 counties/districts into two groups: the counties/districts with the proportion of ethnic minorities greater than 37.8% were known as minority counties, and the counties/districts with the proportion of minorities less than 37.8% were known as non-minority counties. There were a total of 49 minority counties and 37 non-minority counties.

Using the data from the county level in Guizhou province between 1996 and 2007, we computed the MMR, causes composition of maternal deaths, and hospital delivery rate. We used the aggregated county level data in minority counties group and non-minority counties group for comparison. We used two time periods: 1996-2001 and 2002-2007. We computed MMR and hospital delivery rate in minority counties and non-minority counties for each time period, and used odds ratio (OR) and its 95% confidence interval (95% CI) to compare the disparities. Non-minority

counties group was set as the reference group, and the OR in two time periods were used to compare differences.

The statistical analyses were performed using SPSS 17.0. The Chi-square test was used for comparative analysis, and the statistical significance level was set at 0.01. A multiple linear regression model with maternal mortality as the dependent variable, socio-economic, socio-demographic, educational and health services utilization variables as independents were entered and criteria for entry < 0.05 and removal > 0.10, and the statistical significance level was set as 0.05.

4. Results

4.1 Synopsis of Papers I-III

4.1.1 Paper I

Determinants for high maternal mortality in multiethnic populations in western China. Du Q, Næss Ø, Bergsjo P, Kumar BN. *Health Care for Women International* 2009; 30(11):957-70.

Main findings

Xinjiang study identified 339 maternal deaths in 1997. 86.7% of these were women from ethnic minority groups. The MMR in study areas of Xinjiang was as high as 534.2 per 100000 live births. Postpartum hemorrhage (42.4%), internal complications (13.9%), PIH (13.6%) and puerperal infection (9.2%) were the main causes for maternal deaths.

The MMR was negatively correlated with annual net income per capita ($r=-0.350$, $p<0.05$) and farmer annual income per capita ($r=-0.427$, $p<0.05$) in the study areas of Xinjiang. It was, however, strongly correlated with average number of village doctors in study areas of Xinjiang ($r=0.799$, $p<0.001$). Multiple linear regression results

showed that the determinants of MMR were average number of village doctors ($p<0.001$), proportion of villages without doctors ($p=0.001$), and percentage of minority groups ($p=0.006$).

Conclusions

We found ethnic differences in maternal mortality and health services utilization. Ethnicity, economy and health resources should be taken into consideration when making effective measures against preventable cases in western China. It is important to encourage women from ethnic minority backgrounds to improve their self health care awareness and protect themselves from the impact of social and cultural factors. More research is needed on maternal mortality within ethnic minorities in multi-ethnic areas.

4.1.2 Paper II

Differences in reporting of maternal and child health indicators: A comparison between routine and survey data in Guizhou Province, China. Du Q, Næss Ø, Bjertness E, Yang GH, Wang LH, Kumar BN. *International Journal of Women's Health* 2012; 4:295-303.

Main findings

Honghuagang district (urban area) had a larger population but fewer deaths compared with Pingtang (rural area). There was difference in number of live births between the survey data and routine data in both rural (68 vs. 94) and urban area (106 vs. 96). We found one missing maternal death in the rural area, four missing child deaths in two study areas (2 in rural and 2 in urban area). Three of these were neonatal deaths. Most of the health intervention coverage indicators were over-reported in routine data in both rural and urban area. The quality of routine data in urban area was better than rural in general.

Conclusions

MCMS is designed to monitor maternal and child mortality as well as causes for death. MCMS data is used to adjust MMR and U5MR in China. The situation in Guizhou might reflect the situation in most provinces of China. Based on our study results, we can infer that China's MCH routine reporting system is in place and functional. However, more studies are needed to confirm this.

4.1.3 Paper III

The trends in maternal mortality between 1996 and 2007 in Guizhou, China: ethnic differences and associated factors. Du Q, Lian W, Næss Ø, Bjertness E, Kumar BN. (submitted)

Main findings

A declining trend in maternal mortality and rising trend in hospital delivery in Guizhou province was observed in both minority and non-minority counties group. However, ethnic differences between the two groups persist. Increased GDP between 1996 and 2007 ($p < 0.001$), male illiteracy rate ($p=0.023$), and increased hospital delivery rate between 2002-2007 and 1996-2001 ($p=0.043$) were identified as determinants for reduction in maternal mortality.

Conclusions

We found declining trends in maternal mortality in Guizhou province with persisting ethnic differences. The declining trends are associated with economic development, hospital delivery and male illiteracy. Equitable economic development is fundamental to the improvement of health. Effective health education on maternal health is urgently needed for ethnic minority groups, and basic education for the new generation should be enhanced to eradicate the illiteracy.

4.2 Summary of Results

Factors contributing to high maternal mortality

- Low family income was correlated with the high maternal mortality. Equitable economic development is fundamental to the improvement of women's health.
- Lack of human resources and low quality of health services increased the rate of maternal mortality.
- Low health services utilization by ethnic minority women was related to high maternal mortality in multi-ethnic areas.

Quality of routine MCH reporting system

- Underreporting of live births, maternal deaths and child deaths, over-reporting of some maternal and child health indicators was verified in the study, but no large gaps were found with respect to these between the routine data and survey data in Guizhou.
- The quality of routine MCH reporting system is good, but there is still some room for improvement.

Trends in maternal mortality

- The declining trends in maternal mortality in Guizhou province are associated with economic development, hospital delivery and male literacy.
- Ethnic differences in the trends in maternal mortality in Guizhou province persisted, but the gaps have narrowed over time.

5. Discussion

5.1 Methodological discussion

We conducted two studies: a retrospective study in Xinjiang region and a longitudinal retrospective study in Guizhou province. These aimed to investigate the determinants and trends in high maternal mortality within western China, and investigate the quality of MCH routine reporting data within China. The support from the MOH, National Center for Women and Children's Health and Provincial Health Bureaus was very valuable in the completion of this study. This governmental cooperation facilitated the collection of the routine data and the conduction of household interviews. Random sampling and a high response rate in this study increased the reliability of the results. Despite the strengths of the study, the findings and conclusions of this thesis should be considered alongside the limitations of the study (Papers I-III).

5.1.1 Study design

A study design is selected according to the aim, specific objectives and research questions of the study. The main objective of this thesis was to investigate the determinants and trends in maternal mortality. For this purpose, a retrospective study was deemed suitable. Retrospective studies have some inherent weaknesses. The most important one of these is they cannot establish a causal relationship between death and its associated factor.

5.1.2 Selection bias

Internal validity is the extent of consistency between study results and the real situation of study subjects, any scientific study needs to test internal validity. The systematic errors are called as biases, biases are seen as the main causes to influence internal validity. Random sampling is an effective way to ensure internal validity.

Selection bias refers to a systematic error in the study due to the factors influencing participation.[58,59] The study areas in Xinjiang study (Paper I) were not sampled completely at random for practical reasons. This was because random

sampling would have involved dramatic increases in cost with uncertain benefit. The study counties were selected in the areas with high levels of poverty and maternal mortality. As sampling was based on actual needs and not random sampling, we believe that the Xinjiang study could contain selection bias. Fortunately, our sample size was large enough. Out of a total of 96 counties in Xinjiang region, 24 counties were selected as the sample study areas. The inclusion of all the townships in 24 counties with high response rate strengthened the selection process of the study. Therefore, selection bias is not expected to be a major limitation to the interpretation of our findings, but we need to be cautious to make generalizations in the whole region.

Pingtang county and Honghuagang district were randomly sampled as study sites from the total 26 surveillance sites in Guizhou province for studying the quality of MCMS. Though only one township was randomly selected in each study site due to time and cost restrictions, we took different levels into consideration in the sampling process including the counties, townships and villages to ensure that all levels in the population were represented, so the results are not expected to be biased.

5.1.3 Information bias

Information bias is a systematic error due to the problem of data collection or measurement. Recall bias belongs to differential information bias, which arising from different memory ability of interviewees.

Our studies were retrospective so we cannot rule out recall bias. Although maternal or child deaths are an unforgettable event for the family, a time interval of one to two years possibly produced information bias in the utilization of maternal and child health services. We sequenced the respondents in accordance with the close to far relatives to ensure that information collected more reliable. However, some informants systematically tend to under-report or over-report.[60] In the case of hospital-based deliveries and deaths, we checked the patients' medical records and

"Hukou" to reduce these biases, but for home deliveries and deaths, we had to depend on the informants. This could have led to information bias.[61] The trained investigators asked and explained each question to the participants in a manner that all participants regardless of place, ethnicity and language could understand.

Ethnic minorities are a considerable proportion of the total population in Guizhou and Xinjiang. As 46% of the total population in Xinjiang region identified as Uygur, this meant that the original questionnaires in Chinese had to be translated into Uygur in the Xinjiang study. Original questionnaires in Chinese in Guizhou household survey were used without translation into dialects that lack written formats, such as Buyizu and Miaozu. Spoken dialect translation might cause small information loss or difference.

Among ethnic minorities particularly from rural areas, there were cultural differences in both comprehending and responding to questions, which could have led to misclassification.[62] To limit this type of misclassification, we carefully selected MCH professionals from ethnic minority backgrounds to assist those with language difficulties.

In rural China, especially in western China, a large proportion of pregnant women and babies die at home without health professionals' participation. We used verbal autopsy to identify maternal deaths in the Xinjiang study (Paper I). The reliability and validity of verbal autopsy has not been established.[63] It has been criticized for possibly misclassifying maternal deaths, particularly those occurring early in pregnancy and indirect causes of maternal death.[64,65] This misclassification may result in over - or underestimation of mortality rate, and report inaccurate cause of death.

Although we have good quality routine data from Guizhou in the longitudinal retrospective study (Paper III),[66] we cannot rule out information bias. This is

especially the case for the period of 1996-2000, when reporting system had some limitations.

Our investigators were all professional health care workers from county/district level, and trained by the principle investigator (author) who was always available in person or by telephone to deal with difficulties, the above possible information biases were controlled to a minimum level and the estimates are not expected to be biased in general.

5.1.4 External validity

In paper I, the Xinjiang study areas were not completely sampled at random for practical reasons. In this study, we aimed to analyze factors related to maternal mortality in each county as a whole. Due to lack of vital registration providing individual level controls, this must be kept in mind when making inferences. This means the individual level of maternal deaths is not compared with individuals in the same reproductive age in the same county.[67,68] Therefore, the representation of samples to entire Xinjiang region needs to be considered.[69]

Due to logistical reasons and time schedule, only two study sites were sampled out in Paper II. However, random sampling and a high response rate in the study increased the reliability of the results and the representativeness of Guizhou province. The Guizhou household survey was conducted to compare key maternal and child health indicators between the routine data and survey data. As this study was conducted in Guizhou province, it might be difficult to say something about the data quality of MCH routine reporting system within the whole country.

We used county level aggregated data to analyze the associated factors of trends in maternal mortality in the Guizhou trends study (Paper III). However, we lacked vital registration at an individual level. We need to take this into account when drawing inferences. This study was conducted in Guizhou province, which is typical

of the western region, but it is impossible to make generalizations about the ethnic minorities within the whole country.

5.2 Discussion of main findings

5.2.1 The quality of MCMS

MMR, IMR and U5MR are common indicators used to monitor the health status of a country or region and progress towards the achievement of MDG 4 and 5.[2,9,10] Data from MCMS are used to estimate the maternal and child mortality rate in China, and the quality of MCMS for MDG 4 and 5 surveillance is meaningful. Although MCMS in China has been strengthened and its quality has improved in recent years, the quality of MMR, IMR and U5MR surveillance data is often not well known internationally.[55,56] Our survey results show that MCMS in Guizhou is functional and is of good quality. No large gaps can be identified between the routine data and survey data.

Several published papers have highlighted the problem of under-reporting of live births and neonatal deaths internationally. This finding was verified by our results.[70-73] We found that the number of births and deaths in our survey was larger than it was in routine reporting data in both urban and rural areas with the largest gap being the number of live births and neonatal deaths. This was especially the case in remote and poorer areas. Under-reporting of births, maternal deaths and neonatal deaths was due to a substantial proportion of births and deaths occurring at home.[56,74-76]

Underreporting in rural China is due to two reasons: 1) the lack of understanding of the importance of registering and poor access to registration facilities, and 2) the rural to urban migration.[77] Successful experience of mobile registration systems from other countries could be introduced to improve civil registration in remote areas.[78] The significance and necessity of birth and death registration of a newborn is not well recognized in rural China.[79,80] Additionally, in the rural areas of western China and

especially within ethnic minority groups, home births are preferred. Social norms prevent families from disclosing maternal and neonatal death occurring at home.[81] Nearly half of the births were not registered within the legally prescribed time period in both international and Chinese context.[77,82]

With increasing migration from rural areas to the cities reporting back to the rural hometowns for the sake of registering birth and deaths is on the decline given the time and cost constraints. Parents prefer to wait until their children reach school age.[56,83] Strict family planning policies, fines and other penalties for exceeding the permitted number of children lead to unregistered births and underreporting. Children who are unregistered cannot enjoy normal civil rights and welfare until their parents pay the social compensation fees. The number of compensation fee depends on local economic conditions.

We found that most of the coverage rates of MCH indicators in our survey were lower than they were in routine data in both urban and rural area of Guizhou. The largest gap was postnatal visits and systematic management for children under the age of three. Other studies have reported similar findings.[75,84,85] It is difficult to implement systematic management for children under the age of three within the current Chinese health system, especially in rural areas due to inadequacy of human resources, poverty and unawareness of care-givers.[52,86-89] The reason for low postnatal visit rates in the urban areas may be linked to increase in migrant populations leading to overworked community health workers.[75]

Every birth and death counts, and accurate MCH information is important for MCH policy-making, health planning and reasonable health resource allocation at all levels. Accurate MCH information is important in improving maternal and child survival. Furthermore, monitoring and evaluation of indicators for MDG 4 and 5 will remain objective only if estimations are made based on good reporting systems.[90-92]

5.2.2 Factors contributing to high maternal mortality

Maternal deaths have been a long-term problem in China. This is especially the case in western China. Some researchers have studied maternal mortality in China, but most have focused on the estimation and medical causes for maternal deaths. Few researchers have examined the underlying causes for maternal deaths, especially for maternal deaths occurring out of health care institutions. Only a few studies have considered ethnic differences in maternal mortality within China. We conducted this study to investigate the determinants and patterns of associations with high maternal mortality and ethnic differences in the trends in maternal mortality in western China. This study provides evidence that can be used to address the various factors leading to maternal deaths, as well as in raising awareness about health inequality within China. This study can also be instrumental in the designing effective strategies and health policies that aim to reduce maternal mortality even further in western China.

Although economic factors associated with maternal mortality are widely documented,[93-96] we would argue that the influence of economic factors is complicated. When the economy develops to a certain extent, other related factors will influence maternal mortality much more. The multivariate analysis from the Xinjiang study showed that there was no significant relationship between economic factors and MMR. One report refers to some developing countries with low economic level, with relatively low MMR. This can be attributed to improvement in the social and health status of women, strengthening of health care and health promotion for pregnant women, advanced service level and quality of obstetrics.[97] We believe that although poverty is a major underlying determinant of health, poverty eradication alone will not be the panacea for reducing maternal mortality. Economic status may be associated with other factors that in turn play a greater role.[98]

The situation of migrant population in the city is unstable, their household register (Hukou) and medical insurance (NCMS) are in their rural hometown. The pregnant woman may only receive the NCMS reimbursement and national subsidy for hospital delivery if she is domiciled in a rural area. Migrant pregnant women may,

therefore, incur additional charges for delivering in an urban hospital. Added hospitalization costs of delivering in urban areas may also affect the uptake of health services in cities. Due to high costs, some migrant rural women may choose to return to their place of domicile in the rural areas to deliver babies whereas some may choose to deliver their babies at home in urban areas without the help of skilled health workers.

One of the findings in our study was that ethnic minorities have lower utilization rate of health services. Aspects of the relationship between ethnicity and maternal mortality have been ignored. Hospital delivery has proved to be the most effective way to reduce the maternal mortality ratio.[18,99] Poverty was the biggest barrier to hospital delivery within the entire country in the last century. Reduction of maternal mortality in western China is attributed to the improvement of hospital delivery, and this finding is consistent with other studies.[20,100-102] The Chinese government works alongside with the WHO, UNICEF, the World Bank, and UNFPA to improve the health status of women and children, and especially to reduce high maternal and child mortality level in poor western areas. The MOH has organized and implemented the "Reducing Maternal Mortality Ratio and Elimination of Newborn Tetanus" Project, allocating over 200 million US Dollars for this project during 2000–2008, to promote hospital delivery in poorer and remote areas, to improve the quality of obstetric services and strengthen MCH emergency referral systems.[103] All of these have contributed to the improvement of hospital delivery and quality of care in western China.

Although progress has been made in western China, hospital delivery rates in this part of the country are still lower than the national average. The fixed-price for normal delivery at township hospital is about 600 CNY. The Chinese government launched hospital delivery subsidy program for rural areas in 2000. Under this program, each rural pregnant woman will get 400 CNY for normal delivery from this program, and as of 2003, get 200 CNY from New Cooperative Medical Scheme. This

means that individuals residing in rural areas have had the possibility to receive free hospital delivery services for a few years. These provisions help improve the hospital delivery rate overall. However, for ethnic minorities, these decisions do not only involve economic concerns but are also part of their traditional culture, beliefs and customs.[81,104] There is an association between illiteracy and the choice of hospital delivery found in one study in Yunan province of China.[101] Our findings are consistent with this study. However, our analysis showed that male illiteracy is the most significant factor, and this could be explained by gender inequity. Gender inequities are common in rural China. The low position of women within rural Chinese society restricts their utilization of health services, as they usually have no decision-making power in the family.[105] The overall illiteracy rate for Guizhou province was 20%, male illiteracy rate was 10% and female illiteracy rate was 31%. It is important to promote gender equity further. Access to basic education and culturally appropriate health education are needed to promote health seeking behavior and protection of life. It is important to know what cultural beliefs, taboos, ethical and economic factors may influence the use of health services in minority areas so that culturally appropriate health education programs can be run effectively to promote health seeking behavior.

Village doctors play an important role in rural health care. Their qualifications and geographic distributions affect both the quality and availability of health services. In most rural areas, village doctors undertake basic health care and management for pregnant women, antenatal care, postnatal visits and home deliveries. There are still a large proportion of pregnant women who choose to deliver at home. As this is the case, village doctors and registered birth attendants are essential part of the rural health infrastructure, and they play an important role for the bottom of the three-tier health care network. Due to technological and equipment limitations, village doctors and birth attendants are not well equipped to deal with medical emergencies that may occur during home deliveries. Costs, long-term influence of tradition and custom as well village doctors delivering babies at home act as restrictive factors in pregnant women delivering at hospital.[106]

Research suggests that although safe motherhood is a high priority program in many countries including China, a considerable proportion of deliveries still occur at home and are attended by traditional and non-registered birth attendants. Sri Lanka, D.P.R Korea and Thailand have been able to address these issues successfully, thereby substantially decreasing maternal mortality.[20,99] Screening for high-risk pregnancies can be used as a strategy to promote hospital-based delivery in areas with low hospital delivery rates. It is equally important to accommodate for hygienic home deliveries, especially in remote rural areas of Guizhou and Xinjiang. The clean home delivery kit should be advocated for use in each case of home delivery to reduce the risk of maternal and neonatal infection.[107-109]

A higher risk of maternal death in medical institutions indicated that the quality of health services was not satisfactory. The quality of care is key to further reducing maternal deaths occurring in medical institutions.[110,111] Over half of maternal deaths caused by obstetric hemorrhage are preventable if quality of care is improved.[112] Obstetric hemorrhage was the major cause of maternal deaths and its proportion maintained at a level of over 60% in Guizhou. Antenatal check-up and postnatal visits can help detect health problems of pregnant women in time, and enable them to receive timely treatment to avoid maternal deaths.[113] Attending antenatal care is helpful for tackling the problem of post-partum hemorrhage.[114]

5.2.3 The trends in maternal mortality

Despite the declining trend in maternal mortality in Guizhou province, differences between minority counties and non-minority counties persisted. However, the gap between these counties has narrowed over time. Trends in hospital delivery in Guizhou province have increased in the same time period. The gaps between minority counties and non-minority counties have been reduced over time. Our findings show that economic development, hospital delivery and male illiteracy are the factors associated with reduced maternal mortality.

We found significant differences in maternal mortality between minority and non-minority counties. This disparity has persisted over time, albeit it has been narrowed. It has been shown that the reduction in maternal mortality is strongly associated with socio-economic development in China. Our findings confirm this in the Guizhou province.[81,100-102] The GDP of non-minority counties was three times more than minority counties in Guizhou, and this gap is increasing. Many minority counties in the western region are the least developed counties located in mountainous areas. They lack funds, there are shortages of health personnel and high quality care is unavailable.[44,52,115] The lower the socioeconomic status, the worse the health. Low standards of living are fundamental to health inequity.[102,116] The central and local governments need to develop economic policies aimed at ethnic minorities to improve their standards of living and health status. These policies need to be aimed at especially women and children. Health policies and programs should embrace all related sectors, not just the health sector. Otherwise, it will not work properly, as before.

Maternal survival strategies for reducing maternal mortality have been applied nationwide for many years, and regular maternal health interventions have been expanded to the whole country. Ethnic differences persist in socio-economic development and the utilization of health services. Equitable economic development is fundamental to the improvement of health. Under the current economic conditions, limited resources and care should be delivered to those who most need it in ethnic minority areas. Effective health education on maternal health is urgently needed for ethnic minority groups, and basic education for the new generation should be enhanced to eradicate illiteracy.

6. Policy implications

The aim of this study was to provide scientific evidence for policy-making to reduce maternal mortality further in western China. The gap within maternal mortality rates between urban and rural areas, minority and non-minority counties has not widened

over time. However, the MMR in Guizhou province was still much higher than the national average level, and the MMR in minority counties was higher than non-minority counties in Guizhou. More progress is needed to improve the health of women in the least developed rural counties and ethnic minority areas.

The government should further advocate and improve hospital delivery in remote rural areas and multi-ethnic areas in western China. It is important to encourage women from ethnic minority backgrounds to improve their self health care awareness and protect themselves from the impact of social and cultural factors through promoting basic education as well as culturally appropriate health education. Use the ways of health education to disseminate health information and behavior to target population, mobilize individual, family and community participation to pay more attention to maternal health by inter-personal communication. More research is needed on maternal mortality within ethnic minorities in multi-ethnic areas.

The data from MCMS shows that China is on track to achieving the MDG 5, and has achieved the MDG 4 ahead of time. Inter-agency Group on Child Mortality Estimation data in the countdown to 2015 decade report (2000-2010) gave a different estimation on U5MR in China, and suggested that China is approaching the MDG 4 target but still needs some time to achieve it.[117,118] The quality of routine reporting system for maternal and child health in China should be further improved to confirm this. It is recommended that health personnel at all levels take into account the underreporting of births and deaths and over-reporting of health interventions. Accurate, and reliable data collection is essential for Chinese policies aimed at women and children and public health.

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ANNEX 1. Papers I-III

Paper I Determinants for high maternal mortality in multiethnic populations in western China

Paper II Differences in reporting of maternal and child health indicators: A comparison between routine and survey data in Guizhou Province, China

Paper III The trends in maternal mortality between 1996 and 2007 in Guizhou, China: ethnic differences and associated factors

I

II

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ORIGINAL RESEARCH

Differences in reporting of maternal and child health indicators: A comparison between routine and survey data in Guizhou Province, China

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Background: The quality of routine data, such as the maternal mortality ratio (MMR), infant mortality rate (IMR), and under-five mortality rate (U5MR) is often questioned. The objective of this study was to compare routine and survey data on key maternal and child health indicators, including the MMR, IMR, and U5MR in the Guizhou Province of China.

Methods: In 2008, an urban area and a rural area in the Guizhou Province were randomly selected. All households in the selected areas were included and, of the total 5466 households therein, 5459 were visited. The response rate was 99.9%. Survey data were collected from mothers (46.0%), fathers (32.5%), grandmothers (11.1%), grandfathers (9.0%), and other caregivers (1.4%). Data from routine records of the health bureaus in selected areas were reviewed for the same indicators. The Chi-square test was used to study the differences between routine data and survey data.

Results: We found the differences between the routine and survey data live births in the survey data (68) was fewer than in the routine data (94) in the rural area, while live births in the survey data (106) was larger than in the routine data (96) in the urban area. The IMR was higher in the survey data (51.7 per thousand) as compared with routine data (31.6 per thousand). The U5MR was higher (69.0 per thousand) in the survey data than in the routine data (42.1 per thousand). Indicators related to the coverage of maternal and child health interventions were over-reported in routine data.

Conclusion: Small differences were observed between routine data and survey data in Guizhou, one of the poorest areas of China. The quality of routine data in urban areas was better than in rural areas.

Keywords: maternal and child health indicators, routine and survey reporting, China

Introduction

The maternal mortality ratio (MMR), infant mortality rate (IMR), and under-five mortality rate (U5MR) are common indicators used to monitor the health status of a country or region and progress towards the achievement of millennium development goals 4 and 5.[1–3] Despite being widely used for this purpose, the quality of MMR, IMR, and U5MR surveillance data is often not well known.[4,5]

Since 1980, China's family planning policy restricts the number of children per family. This policy allows Han Chinese (Hanzu) couples in urban areas to have only one child, and rural Hanzu couples to have two children if the first child is a girl. Ethnic minorities are permitted two children, and ethnic minorities in pastoral areas are permitted three children. Violation of family planning policies results in heavy fines and may cost the parents their jobs.[6] To avoid being penalized, noncompliant families tend

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to have home births. As a result, many home births and deaths go unreported, leading to differences between routine and survey data.

The most common methods of checking the quality of routine data in China include interviewing household members, and checking hospital, public security, and family planning department records.[7]

In China, current maternal and child health (MCH) indicators come from routine reporting data sources. Figure 1 shows the structure of the Maternal and Child Health Reporting System in China. The Ministry of Health (MOH) estimates the mortality at the national level and the coverage of health interventions based on these routine data. Reporting forms for MCH indicators are developed by the MOH and National Bureau of Statistics of China, and are considered to be statutory reports. Every county and district in all the 31 provinces (autonomous regions and municipalities) in Mainland China are therefore obliged to fill out these forms.[8]

China established a national maternal mortality surveillance system in 1989. Initially it covered 247 maternal mortality surveillance sites and a population of 100 million individuals, which was approximately 8% of the total population in China. A national child mortality surveillance system was established in 1991, initially covering 81 surveillance sites and a population of 8.5 million. Birth defect surveillance was established in 1986, and was a hospital-based surveillance system. In 1996, the MOH incorporated maternal mortality surveillance, child mortality surveillance, and birth defect surveillance into a national Maternal and Child Mortality Surveillance System (MCMS). The number of surveillance sites has been expanded from 116 in 1996 to 336 as of today, comprising 126 sites in urban areas and 210 sites in rural areas.[9] The MCMS reports the number of live births, the number and causes of maternal and child deaths, and provides scientific evidence for health officials and MCH workers through data analysis and utilization.

The MOH has carried out national health service surveys every 5 years since 1993 (excluding Hong Kong, Macau, and Taiwan) to provide data for health planning. The MCH is one part of this survey, and includes main MCH indicators, such as the MMR, IMR, hospital delivery rate, and antenatal care coverage. In addition, a few international cooperation

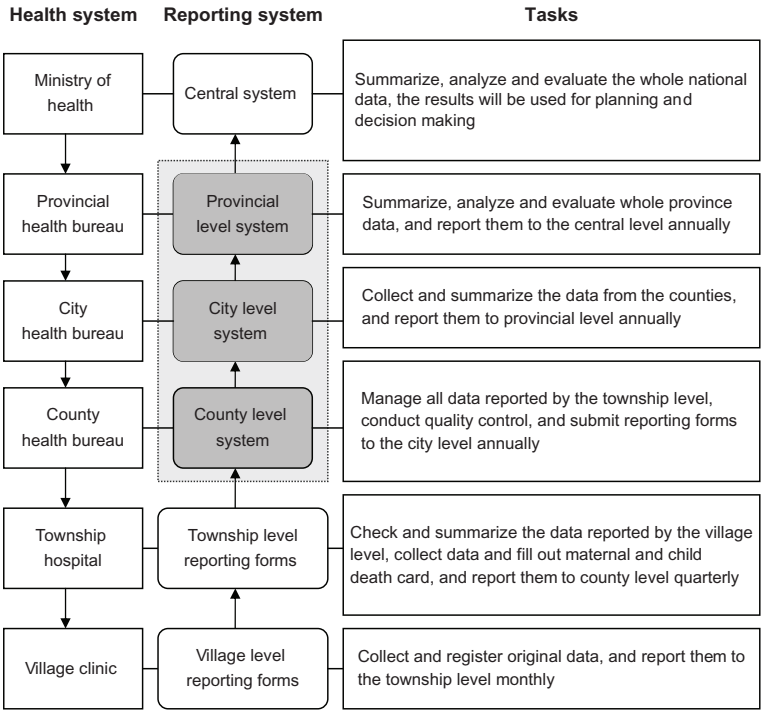

Figure 1 The structure of maternal and child health reporting system in China.

projects conduct baseline and endline surveys to evaluate the effect of MCH interventions.[10] MCMS is assumed to be the most reliable data source for estimation of maternal and child mortality in China. In 2008, the MMR in China was 34.2 per 100,000 live births, the IMR was 14.9 per 1000 live births, and the U5MR was 18.5 per 1000 live births.[9]

Guizhou is a remote and poor province with 37.8% of ethnic minority groups in southwest China.[11] We conducted a study in Guizhou with the aim of comparing maternal and child mortality as well as other selected maternal and child health indicators between routine data and survey data. This is the first internationally published study in China that compares key maternal and child health indicators from routine data and those from survey data.

Materials and methods

Study area

Guizhou is a mountainous province located in southwest China. It is among the poorest provinces in China, and its per capita gross regional product ranks the lowest in the country.[12] Maternal and child mortality rates in Guizhou are ranked the highest in China, with poor maternal and child health status and health service provision.[13,14]

The district of Honghuagang was randomly selected as the sample urban area from a possible eight urban surveillance sites. Similarly, the county of Pingtang was chosen as the sample rural area from 18 possible rural surveillance sites. One street from Honghuagang and one township from Pingtang were once again randomly identified and every household within these areas was surveyed.

Study population

The study was carried out during April–November 2008 in Guizhou. All households within a selected township/street were included as participants in a household survey. A total of 5459 households from 5466 were visited, with 3563 being urban and 1896 being rural. The response rate was 99.9%. Figure 2 shows a flow chart of the sampling framework and study population.

Data collection

This study was approved by the National Center for Women and Children's Health and Guizhou Provincial Health Bureau. Hard copies of original local records of routine MCH data were obtained from the local health bureaus in Pingtang and Honghuagang. Three questionnaires covering the same MCH indicators as the routine data source were used to collect survey data by household interview from October 1, 2007 to September 30, 2008 (time period was consistent with that of the routine data source) in the study areas.

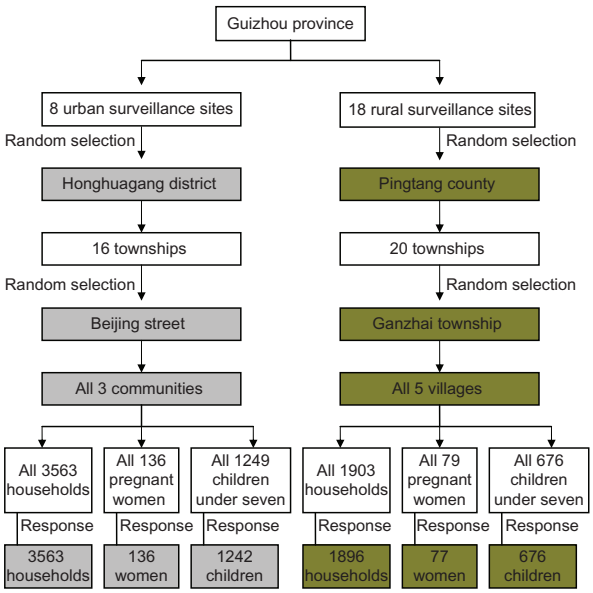

Figure 2 Flow chart of sampling framework and study population in Guizhou province.

Questions about socioeconomic characteristics were also included. All questionnaires were in the Chinese Mandarin language, but for about 10% of elderly minority respondents who could not understand Chinese Mandarin, the questions were translated into minority languages by local translators. Differences in translation were discussed and corrected by the investigators.

We trained 24 local MCH workers as investigators in the rural and urban areas on the contents of the questionnaires, interpretation of each question, classification of maternal and child deaths according to the ICD-10,[15] as well as skills for conducting the interview. The questionnaires were pretested by local investigators, problems were identified, and questionnaires were modified accordingly.

The investigators visited a household three times, and if they could not find a respondent in the household by the third visit, the household was excluded. The respondents in our sample were mothers (46.0%), fathers (32.5%), grandmothers (11.1%), grandfathers (9.0%), and other caregivers (1.4%). Written informed consent was obtained from each respondent before the interview. The data were collected during August–November 2008. The trained investigators were responsible for entering the answers. They also checked each other's forms for errors and completeness daily, and questionnaires with omissions were investigated further and corrected within one week. We personally checked all questionnaires each month after the data collection was completed. Doubts and further questions, if any, were marked and sent back for correction. The survey results were then compared with the routine data obtained from the local County and District Health Bureau.

Table 1 Definitions of main selected indicators

Indicator	Definition
Live birth	As defined by the WHO, a live birth is any baby who upon delivery from its mother breathes or shows any other evidence of life, such as a heartbeat, pulsation of the umbilical cord, or definite movement of voluntary muscles, irrespective of duration of the pregnancy. In China, a live birth is defined as any newborn with a gestational age of ≥ 28 weeks or birth weight > 1000 g, who upon delivery from its mother has any of the four vital signs (heartbeat, breath, pulsation of the umbilical cord, and voluntary muscle contraction).[8,16]
Maternal death	Death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management, but not from accidental or incidental causes.[8]
MMR	Number of maternal deaths during a given time period per 100,000 live births during the same period.[17]
IMR	Number of infant deaths during a given time period per 1000 live births during the same period.[3]
U5MR	Number of child deaths under five years during a given time period per 1000 live births during the same period.[3]
Hospital delivery rate	Number of births attended by skilled health personnel in medical institutions at the township level and above in a given time period per 100 live births in the same period.[8]
Antenatal care rate	Number of women with a live birth who received antenatal care provided by skilled health personnel at least once during pregnancy in a given time period per 100 live births in the same period.[8]
Postnatal visit rate	Number of women with a live birth who received postnatal visit provided by skilled health personnel at least once during the first 28 completed days after delivery in a given time period per 100 live births in the same period.[8]

Abbreviations: WHO, World Health Organization; IMR, infant mortality rate; MMR, maternal mortality ratio; U5MR, under-five mortality rate.

Selection and calculation of indicators

We selected main MCH indicators from the routine data source for comparison of the routine data and survey data, including demographics, maternal health, newborn health, and child health and nutrition. Sociodemographic and socioeconomic indicators from our survey data were selected for comparison between the rural and urban areas. We calculated the selected MCH indicators using the same method as that used by the routine surveillance system. Table 1 shows the definitions of the main selected indicators.

Table 2 Basic characteristics of study areas in Guizhou for 2008 from routine dataset

	Area (km^2)	Total population	Children under five years	Live births	Maternal deaths		Infant deaths		Child deaths under five years	
					n	Rate (MMR)	n	Rate (IMR)	n	Rate (U5MR)
Pingtang county	2815	313,287	16,204	2973	5	168.2	110	37.0	138	46.4
Ganzhai township (rural area)	–	9252	438	94	0	0	6	63.8	7	74.5
Honghuagang district	624	476,514	23,290	4846	2	41.3	55	11.4	71	14.7
Beijing street (urban area)	–	13,745	884	96	0	0	0	0	1	10.4

Abbreviations: IMR, infant mortality rate; MMR, maternal mortality ratio; U5MR, under-five mortality rate.

Data analysis

Statistical analyses were performed using SPSS 15.0 Statistical Software for Windows (SPSS Inc, Chicago, IL). Frequency analysis was used for descriptive statistics. The Chi-square test was used for comparative analysis.

Results

Table 2 shows the basic characteristics of Honghuagang district (urban area) and Pingtang county (rural area). The urban area had a larger population but fewer deaths compared with the rural area (Table 2). The rural area was poorer than the urban area (Table 3). Children under five years (83.8%) and pregnant women (72.7%) in the rural area were mainly from the ethnic minorities, while those in the urban area were mainly Han Chinese (Table 3). A larger proportion of pregnant women (10.4%) in the rural area were unmarried (Table 3). Pregnant women in the urban area were more educated than those in the rural area (Table 3). Nearly 40% of children under five years in the urban area belonged to the migrant population (Table 3).

The number of live births (94) was larger than the number of infants (88) in the routine data for the rural area (Table 4). There was a difference in number of live births in both the rural and urban areas, ie, live births in the survey data (68) was fewer than in the routine data (94) in the rural area, but live births in the survey data (106) was larger than in the routine data (96) in the urban area (Table 4). Because the number of live births is the denominator for the mortality and hospital delivery rate, over-reporting of live births is the reason for the lower hospital delivery rate in the rural area. Most statistics in the coverage indicators of maternal and child health interventions were over-reported in the routine data. In the urban area, all indicators showed discrepancies between the routine data and survey data, except for the number of maternal deaths (0) and management rate of high-risk pregnant women (100%). We found one missing maternal death in the rural area and four missing child deaths in two study areas, three of which were neonatal deaths. Table 4 shows the differences between the routine data and survey data for the selected indicators.

We compared routine data between Pingtang county and Honghuagang district, and the quality of data in Honghuagang district was better than in Pingtang county in general, except for the postnatal visit rate, which was poorer in Honghuagang district than in Pingtang county (Table 5).

Discussion

We found the number of births and deaths in our survey were larger than those in the national reporting data in both urban

Table 3 Basic characteristics of study areas in Guizhou for 2008 from survey dataset

	Rural area		Urban area	
Total population	9346		13,762	
Children under five years	488		900	
	n	**%**	**n**	**%**
Gender				
Male	282	57.8	485	53.9
Female	206	42.2	415	46.1
Ethnicity*				
Han	79	16.2	862	95.8
Minority	409	83.8	38	4.2
Migrant status**				
No	484	99.2	561	62.3
Yes	4	0.8	339	37.7
Birth registration				
Yes	470	96.3	869	96.6
No	18	3.7	31	3.4
Annual family income per capita* (CNY)				
<2000	407	83.4	466	51.8
2000–3999	73	15.0	137	15.2
4000–8000	8	1.6	174	19.3
>8000	0	0.0	123	13.7
Pregnant women	77		136	
Ethnicity*				
Han	21	27.3	128	94.1
Minority	56	72.7	8	5.9
Age groups, years				
20–24	35	45.5	47	34.6
25–29	17	22.0	53	38.9
30–34	16	20.8	21	15.5
35–39	4	5.2	6	4.4
≥40	0	0.0	5	3.7
Unknown	5	6.5	4	2.9
Marital status*				
Married	69	89.6	134	98.5
Unmarried	8	10.4	2	1.5
Educational background*				
Primary school and below	37	48.1	8	5.9
Junior high school	39	50.6	72	52.9
Senior high school	1	1.3	26	19.1
Junior college and above	0	0.0	30	22.1
Annual family income per capita* (CNY)				
<2000	57	74.0	56	41.2
2000–3999	16	20.8	38	27.9
4000–8000	4	5.2	18	13.2
>8000	0	0.0	24	17.6
	n	**Rate**	**n**	**Rate**
Live births	68	–	106	–
Maternal deaths	1	1470.6	0	0
Infant deaths	8	117.7	1	9.4
Child deaths under five years	9	132.4	3	28.3

Notes: *Significant difference between rural and urban area using Chi-square testing, $P < 0.01$; **migrant status means a person coming from another province to live in the current province for less than a year, according to the definition of the routine reporting system.

Abbreviation: CNY, Chinese Yuan.

Table 4 Comparison of routine and survey data on selected indicators in selected areas for Guizhou in 2008

Indicators	Rural area			Urban area		
	Routine data	Survey data	Difference between survey and routine data	Routine data	Survey data	Difference between survey and routine data
Demographics						
Live births (n)	94	68	−26	96	106	10
Infants (n)	88	127	39	209	234	25
Children under 3 years (n)	264	300	36	505	530	25
Children under 5 years (n)	438	488	50	884	900	16
Maternal and child deaths						
Maternal deaths (n)	0	1	1	0	0	0
Neonatal deaths (n)	3	5	2	0	1	1
Infant deaths (n)	6	8	2	0	1	1
Child deaths under 5 years (n)	7	9	2	1	3	2
Maternal and child health						
Maternal and newborn health						
Antenatal care (at least one visit) rate (%)	80.65	84.42	3.77	100.00	96.12	−3.88
Hospital delivery rate (%)	65.59	72.73	7.14	100.00	97.09	−2.91
Clean delivery rate (%)	100.00	91.04	−8.96	100.00	99.03	−0.97
Highrisk pregnancy management rate (%)	58.33	50.00	−8.33	100.00	100.00	0.00
Postnatal visit rate (%)	81.91	75.00	−6.91	90.80	53.27	−37.53
Child health and nutrition						
Systematic management rate for children under 3 years (%)	37.55	9.60	−27.95	92.67	83.99	−8.68
Breastfeeding rate (<6 months, %)	100.00	93.75	−6.25	90.10	77.36	−12.74
Exclusive breastfeeding rate (<6 months, %)	97.53	84.38	−13.15	68.81	69.81	1.00

and rural areas, the largest gap being for the number of live births and neonatal deaths. Several published papers have highlighted the problem of under-reporting of live births and neonatal deaths internationally, and this was verified by our results.[17–20]

Economic reforms in China have led to a gradual decentralization from central government level to the provinces. However, this is related to economic development and administrative management only. China is still centralized when it comes to major policies and systems. Therefore, health system policies and the routine reporting system for the entire country remain the same.

The law of the land requires families to go to the registration office to register a new birth. Under the very strict Chinese Hukou system, every birth has to be registered in the local residence area. For this, a permit from the family planning department and a birth certificate from a medical institution are mandatory. Hukou is also necessary for children's education and social benefits.

With increasing migration from the rural areas to the cities, returning back to rural home towns for the sake of registering births and deaths is on the decline, given time and cost constraints. Parents prefer to wait until their children reach school age.[5,21] Strict family planning policies, fines, and other penalties for exceeding the permitted number of children leads to under-reporting. Under-reporting from the villages is due to lack of understanding of the importance of the need to register and poor access to registration facilities.[22] The successful procedures used for mobile registration systems from other countries might be used to improve civil registration in remote areas.[23] The significance and necessity of a births and deaths register for newborns is not well recognized in rural China.[24,25]

The primary reporting of maternal and child deaths is done by village or community health workers. They are required to report maternal and child deaths to the township hospital as soon as possible. The increasing drift of the labor force from rural to urban areas in China poses a difficulty for village and community health workers. Home births are preferred in the rural areas of western China, and especially by ethnic minority groups. Social norms prevent families from reporting maternal and neonatal deaths that occur at home.[26] This necessitates extra vigilance on the part of village health workers for the sake of accuracy. Nearly half of births

Table 5 Over-reporting and under-reporting of routine data compared with survey data between rural area and urban area of Guizhou in 2008

	Rural area (over/under reporting compared with survey data) %	Urban area (over/under reporting compared with survey data) %	Chi-square *P* value
Live births (n)	38.24	–9.43	0.001[a]
Infants (n)	–30.71	–10.68	0.000[a]
Children under 3 years (n)	–12.00	–4.72	0.000[a]
Children under 5 years (n)	–10.25	–1.78	0.000[a]
Maternal deaths (n)	–100.00	0	–
Neonatal deaths (n)	–40.00	–100.00	1.000
Infant deaths (n)	–25.00	–100.00	0.333
Child deaths under 5 years (n)	–22.22	–66.67	0.236
Antenatal care (at least one visit) rate (%)	–4.47	4.04	0.133
Hospital delivery rate (%)	–9.82	3.00	0.282
Clean delivery rate (%)	9.84	0.98	0.019[a]
High-risk pregnancy management rate (%)	16.66	0	0.000[a]
Postnatal visit rate (%)	9.21	70.45	0.000[a]
Systematic management rate for children under 3 years (%)	291.15	10.33	0.000[a]
Breastfeeding rate (<6 months) (%)	6.67	16.47	0.095
Exclusive breastfeeding rate (<6 months) (%)	15.58	–1.43	0.002[a]

Notes: [a]*P* value < 0.05 means significant difference between rural and urban areas. Village health workers are responsible for maintaining monthly records of births and deaths in the village, the number of pregnant women and the number of children under five years. Charts with the data are displayed on the walls of the village clinic. This chart is from a village clinic in the Guizhou province.

are not registered within the legally prescribed time period in both the international and Chinese contexts.[22,27]

Every birth and death counts towards MCH policy-making, health planning, and reasonable health resource allocation at all levels, and helps to improve maternal and child survival. Furthermore, monitoring and evaluation of indicators for millennium development goals 4 and 5 will remain objective only if estimations are made based on good reporting systems.[28–30]

We found that most coverage rates for MCH indicators in our survey were lower than in the routine data for both urban and rural areas of Guizhou, with the largest gap being for postnatal visits and systematic management of children under three years of age. Similar findings were reported by three other studies.[31–33] It is difficult to implement systematic management for children under three years under the present Chinese health system, especially in rural areas, due to inadequacy of human resources, poverty, and unawareness on the part of caregivers.[34–38] The reason for the low postnatal visit rate in the urban area may have been the migration-linked population explosion, leading to overworked community health workers.[31]

MCMS is designed to monitor maternal and child mortality and causes of death, provide scientific evidence for MCH interventions, and to make policy. Quality control is fundamental to ensure the accuracy and reliability of data reporting systems. China establishes its own quality control mechanisms and methods, and MCMS data are used to adjust the MMR and U5MR in China. The completeness of data reporting is required to be 100%, with an error rate of less than 1% when supplying information, an error rate less 10% for reporting live births, and birth and death omission rates less than 15%.[7] If the under-reporting rate is less than 20%, the adjusted mortality rate would be:

$$\frac{\text{Reporting mortality rate}}{1-\text{underreporting rate}}$$

and if the under-reporting rate is at least 20%, the adjusted mortality rate would be:

$$\frac{\text{Reporting deaths} * (1+\text{underreporting rate})}{\text{Reporting live births} * (1+\text{underreporting rate})}.^{7,39}$$

Quality control is done regularly at every level. The counties carry out quarterly quality control checks, and annually at provincial and national levels. Original reporting forms and related records are reviewed at county, township, and village levels, and death records for women of reproductive age and children under five years are maintained by the health department, public security department, and family planning committees. Causes of death, and missing births and deaths information are identified. The Ministry of Health then makes the final adjustments to national maternal and child mortality rates.

Study strengths and limitations

To our knowledge, this study is the first internationally published investigation of the quality of routine MCH data in China. The support of the National Center for Women and Children's Health and Guizhou Provincial Health Bureau was very valuable. This governmental initiative facilitated the collection of routine data and the household interviews. Random sampling and a high response rate in the study helped to increase the reliability of the results.

This was a retrospective study, so we cannot rule out recall bias, because some of the respondents were asked to recall information that was more than one year old. While maternal or child death is an unforgettable event for the family, information bias in the utilization of maternal and child health services cannot be ruled out. This was corroborated with other records and documents available in the households. Original questionnaires were used for the first time, without translation into dialects that lack written formats, like Buyizu and Miaozu. Spoken dialect translation might cause small information loss or differences. The study was conducted to compare key maternal and child health indicators between routine data and survey data, and the study was located in Guizhou Province, so it is impossible to address data quality for the whole country.

Conclusion

Our survey results do not show a large gap between routine and survey data in Guizhou. The situation in Guizhou might reflect the situation in most provinces of China. Based on this study, we can infer that the routine MCH reporting system is in place and functional in China. However, more studies are needed to confirm this. It is recommended that health personnel at all levels take note of the under-reporting of births and deaths and over-reporting of health interventions. Accurate and reliable data collection is essential for Chinese policies aimed at women, children, and public health. While the current data show that China has achieved millennium development goal 4 ahead of time, the quality of the routine reporting system for maternal and child health in China needs to be further improved to confirm this.

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Disclosure

The authors report no conflicts of interest in this work.

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III

ANNEX 2. Questionnaires (English translation)

Questionnaire 1--Screening pregnant women and children under seven

[NAME OF COUNTY/CITY] _____

[NAME OF TOWNSHIP] _____

IDENTIFICATION	
HOUSEHOLD CODE _____	□□□□□□
INTERVIEWER CODE _____	□□□

RESULT OF FINAL VISIT	
RESULT CODES:	□□
1 COMPLETED	
2 PARTLY COMPLETED	
3 NO COMPETENT RESPONDENT AT HOME AT TIME OF VISIT	
4 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME	
5 REFUSED	
6 OTHER (PLEASE SPECIFY)_____	

SUPERVISOR	
NAME _____	
DATE _____	
CODE _____	□□□

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
01	Was there any woman aged 15-49 in your family?	YES. . . . . 1 NO. 2	 →08
02	How many women aged 15-49 in your family?	NUMBER. . . . . ..□□	
03	Was there newly married woman in your family?	YES. . . . . 1 NO. 2	 →06
04	How many newly married women in your family?	NUMBER. . . . . ..□□	
05	How many newly married women did premarital examination?	PREMARITAL EXAM . . . . . □□	
06	Was there pregnant women in your family?	YES. . . . . 1 NO. 2	 →08
07	How many pregnant women in your family?	NUMBER. . . . . ..□□	
08	Was there any death of reproductive-age woman?	YES. . . . . 1 NO. 2	 →12

09	Number of deaths in reproductive age.	NUMBER. . . . . ..□□	
10	Did she die from pregnancy or childbirth?	YES. . . . . 1 NO. 2	 →12
11	Number of deaths died from pregnancy or childbirth.	NUMBER. . . . . ..□□	
12	Was there any child aged under seven in your family?	YES. . . . . 1 NO. 2	 →22
13	How many children under seven in your family?	NUMBER. . . . . ..□□	
14	Was there any child aged under five in your family?	YES. . . . . 1 NO. 2	 →16
15	How many children under five in your family?	NUMBER. . . . . ..□□	
16	Was there any child aged under three in your family?	YES. . . . . 1 NO. 2	 →18
17	How many children under three in your family?	NUMBER. . . . . ..□□	
18	Was there any infant in your family?	YES. . . . . 1 NO. 2	 →20
19	How many infants in your family?	NUMBER. . . . . ..□□	
20	Was there any live birth in your family?	YES. . . . . 1 NO. 2	 →22
21	How many live births in your family?	NUMBER. . . . . ..□□	
22	Was there any death of child under five?	YES. . . . . 1 NO. 2	 →END
23	Number of deaths of children under five.	0～28 DAYS . . . . . .□□ 0～1 YEAR. . . . . □□ 1～3 YEARS. . . . . □□ 4～5 YEARS. . . . . □□	

[NAME OF VILLAGE] _____

Questionnaire 2--Health care status of pregnant women

[NAME OF COUNTY/CITY] _____

[NAME OF TOWNSHIP] _____

[NAME OF VILLAGE] _____

IDENTIFICATION	
HOUSEHOLD CODE _____	□□□□□□
RESPONDENT CODE _____	□□□□□
INTERVIEWER CODE _____	□□□

RESULT OF FINAL VISIT	
RESULT CODES:	□
1 COMPLETED	
2 PARTLY COMPLETED	
3 NO COMPETENT RESPONDENT AT HOME AT TIME OF VISIT	
4 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME	
5 REFUSED	
6 OTHER (PLEASE SPECIFY)_____	

SUPERVISOR	
NAME _____	
DATE _____	
CODE _____	□□□

INFORMED CONSENT

Hello. My name is _____ and I am working with NCWCH. We are conducting a survey that asks about health issues of women in pregnant and childbirth during 2006.10.1--2007.9.30. We would very much appreciate your participation in this survey. This information will help the government to plan health services. The survey usually takes about 20 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Participation in this survey is voluntary, and if we should come to any question you don't want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time. However, we hope that you would participate in this survey since your views are important.

At this time, do you want to ask me anything about the survey?

May I begin the interview now?

Signature of interviewer: _____ Date: _____

RESPONDENT AGREES TO BE INTERVIEWED . .1 RESPONDENT DOES NOT AGREE TO BE INTERVIEWED. . 2→ END

↓

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
01	Are you local resident?	YES. . . . . 1 NO, MIGRATION MORE THAN ONE YEAR. . . . . 2 NO, MIGRATION LESS THAN ONE YEAR. 3	
02	Did this pregnancy or baby in your plan?	YES. . . . . 1 NO. 2	
03	In what month and year were you born?	MONTH . . . . . .□□ DON'T KNOW MONTH . . . . . 99 YEAR . . . . . □□□□ DON'T KNOW YEAR 9999	
04	How old were you at your last birthday? AGE IN COMPLETED YEARS COMPARE AND CORRECT 03 IF INCONSISTENT.	AGE IN COMPLETED YEARS...□□	
05	Ethnicity	HAN MAJORITY. . . . . 1 ETHNIC MINORITIES. 2	
06	What is the highest level of school you attended?	NONE . . . . . 1 PRIMARY . . . . . 2 SECONDARY . . . . . .3 HIGH SCHOOL . . . . . .4 COLLEGE AND HIGHER. . . . . 5 DON'T KNOW 9	
07	Current marital status	CURRENTLY MARRIED . . . . . 1 CURRENTLY LIVING WITH A MAN . . . . . .2 WIDOWED . . . . . 3 DIVORCED . . . . . 4 SEPARATED . . . . . 5 LIVED WITH A MAN . . . . . .6 NEVER MARRIED. 7	 →09 →09 →09 →09 →09
08	What is the highest level of school your husband or partner attended?	NONE . . . . . 1 PRIMARY . . . . . 2 SECONDARY . . . . . .3 HIGH SCHOOL . . . . . 4 COLLEGE AND HIGHER. . . . . 5 DON'T KNOW 9	
09	Where is your house geographically located?	PLAIN AREA. . . . . 1 MOUNTAINOUS AREA. . . . . 2 OTHER AREAS. 3	
10	How long time from your house to the nearest medical institutions by car?	ABOUT ＜10 MINUTES 1	

		10～29 MINUTES . . . . . .2 30～59 MINUTES . . . . . .3 60～119 MINUTES . . . . . 4 120～240 MINUTES . . . . . 5 ＞240 MINUTES . . . . . 6 DON'T KNOW 9	
11	Which level of your annual family income per capita in average? (RMB Yuan)	＜1000. . . . . 1 1000～1999. . . . . 2 2000～3999. . . . . 3 4000～8000. . . . . 4 ＞8000. 5	
12	Does your household have: A radio? An electric fan? A color television? A refrigerator? A washing machine? An air conditioner? A clock? A mobile telephone? A non-mobile telephone? A table? A cabinet? A sofa? A bicycle? A motorcycle or animal-drawn cart? A car or truck?	YES NO RADIO. . . . . 1 2 FAN. . . . .1 2 TELEVISION . . . . . .1 2 REFRIGERATOR. . . . . .1 2 WASHING MACHINE. . . . . .1 2 AIR CONDITIONER. . . . . 1 2 CLOCK. . . . .1 2 MOBILE TELEPHONE . . . .. . 1 2 NON-MOBILE TELEPHONE .1 2 TABLE. . . . . .1 2 CABINET. . . . . .1 2 SOFA. . . . . ..1 2 BICYCLE. . . . . .1 2 MOTORCYCLE. . . . . .1 2 CAR/TRUCK. 1 2	
13	Who in your family usually has the final say on the following decisions: Whether or not to use a method to avoid having children? Whether or not to do antenatal care in the hospital? Whether or not to deliver the baby in the hospital?	RESPONDENT =1 HUSBAND/PARTNER =2 RESPONDENT & HUSBAND/PARTNER JOINTLY =3 NATURAL PARENTS =4 PARENTS IN LAW =5 RESPONDENT & SOMEONE ELSE JOINTLY =6 DECISION NOT MADE/ NOT APPLICABLE =7 METHOD . . . . . 1 2 3 4 5 6 7 ANC . . . . . .1 2 3 4 5 6 7 DELIVERY 1 2 3 4 5 6 7	

	Whether or not to receive postnatal visit at home? Whether or not to spend the money for regular living? Whether or not to spend the money for the health care and medical expenditure?	POSTNATAL CARE. . . . 1 2 3 4 5 6 7 MONEY FOR LIVING . . 1 2 3 4 5 6 7 MONEY FOR HEALTH. .1 2 3 4 5 6 7	
14	If you need help or have a problem, is there someone from your family who you can depend on to: a) give you shelter for a few nights if you need it? b) give you financial support if you need it?	YES NO DK SHELTER . . . . . 1 2 9 ECONOMIC SUPPORT . 1 2 9	
15	Do you yourself control the money needed to buy the following things? Vegetables or fruits? Milk or eggs? Clothes for yourself? Any kind of medicine for yourself? Health products like folic acid, calcium tablet, vitamins?	YES NO DB VEG/FRUIT . . . . . 1 2 3 MILK/EGG . . . . .1 2 3 CLOTHES . . . . 1 2 3 MEDICINE . . . . .1 2 3 HEALTH PRODUCTS . 1 2 3	
16	Now I would like to get your opinion on some aspects of family life. Please tell me if you agree or disagree with each statement: The important decisions in the family should made only by the men of the family. If the wife is working outside the home, then the husband should help her with household chores. A married woman should be allowed to work outside the home if she wants to. The wife has a right to express her opinion even when she disagrees with what her husband is saying. A wife should tolerate being beaten by her husband in order to keep the family together It is better to send a son to school than it is to send a daughter.	AGREE DIS AGREE DK FAMILY DECISIONS BY MEN 1 2 3 HUSBAND SHOULD HELP 1 2 3 WOMEN SHOULD WORK 1 2 3 WIFE TO EXPRESS OPINION 1 2 3 TOLERATE BEING BEATEN 1 2 3 BETTER TO SCHOOL SON 1 2 3	
17	Did you remember your childbearing history?	GRAVIDITY . . . . □□ PARITY . . . .□□ INDUCED ABORTION AND LABOR . . . .□□	
18	Did you establish a card in health facilities when you were defined as pregnancy?	YES. . . . . 1 NO. 2	→20
19	Did you remember the gestation week of the card establishment?	WEEKS. . . . .□□	

20	Were you screened as high-risk pregnancy?	YES. . . . . 1 NO. 2	
21	Did you have done antenatal care?	YES. . . . . 1 NO. 2	→23
22	Why you didn't do antenatal care?	NO MONEY. . . . . .1 NO TIME. . . . . .2 INCONVENIENT TRAFFIC. . . . .3 THINK UNNECCESSARY. . . . . 4 DON'T KNOW IT. . . . . 5 DON'T BELIEVE MEDICAL INSTITUTION. . . . . ..6 UNPLANNED PREGNANCY. . . . . 7 FAMILIES DON'T ALLOW 8	→28
23	Did you have an antenatal-care card/book? IF YES: IF POSSIBLE, ASK TO SEE THE CARD/BOOK.	YES . . . . . 1 NO, CARD/BOOK KEPT WITH FACILITY . . . . . 2 NO CARD/BOOK USED 3	
24	Where you did antenatal care more often?	HOSPITAL AT PROVINCIAL (PREFECTURE) LEVEL . . . . . 1 HOSPITAL AT COUNTY LEVEL. . . . . 2 TOWNSHIP HOSPITAL. . . . . .3 VILLAGE STATION. . . . . .4 PRIVATE CLINICS. . . . . .5 HOME. 6	
25	How many times of antenatal care you had in total?	1 time. . . . . 1 2～3 times. . . . . 2 4～5 times. . . . . 3 6～7 times. . . . . .4 ⩾8 times. 5	
26	Whether the provider performed the following procedures during antenatal care: Take the client's blood pressure Weigh the client Palpate the client's abdomen for fetal presentation Palpate the client's abdomen for fundal height Listen to the client's abdomen for fetal heartbeat conduct ultrasound Examine the client's breasts Conduct vaginal examination/exam of perineal area Perform or refer for anemia test	YES NO DK BP. . . . . .1 2 3 WEIGHT. . . . . 1 2 3 FETAL PRESENTATION...1 2 3 FUNDAL HEIGHT. . . . . .1 2 3 FETAL HEARTBEAT. . . . ..1 2 3 B SCANNER. . . . . .1 2 3 BREAST EXAM. . . . .1 2 3 VIGINAL EXAM. . . . . .1 2 3 BLOOD TEST. 1 2 3	

	Perform or refer for urine test Perform or refer the client for a syphilis test Perform or refer for HIV test	URINE TEST. . . . . 1 2 3 SYPHILIS TEST. . . . . 1 2 3 HIV TEST. 1 2 3	
27	What did you think the affordability of cost for antenatal care based on your economic status?	CHEAPEST. . . . . 1 CHEAP. . . . . .2 MIDDLE. . . . . 3 EXPENSIVE. . . . . 4 MOST EXPENSIVE. 5	
28	What was the pregnancy outcome?	GOOD. . . . . 1 NATURAL ABORTION. . . . . .2 INDUCED ABORTION. 3	→END FOR PREGNANT WOMEN
29	Where you delivered the baby?	HOSPITAL AT PROVINCIAL (PREFECTURE) LEVEL . . . . . 1 HOSPITAL AT COUNTY LEVEL. . . . . 2 TOWNSHIP HOSPITAL. . . . . .3 VILLAGE STATION. . . . . .4 HOME. . . . . 5 EN ROUTE. . . . . 6 PRIVATE CLINICS. 7	→31 →31 →31
30	Why you didn't deliver the baby in the hospital?	NO MONEY. . . . . .1 INCONVENIENT TRAFFIC. . . . .2 THINK UNNECCESSARY. . . . . 3 DON'T KNOW IT. . . . . 4 DON'T BELIEVE MEDICAL INSTITUTIONS. . . . . 5 UNPLANNED PREGNANCY. . . .6 FAMILIES DON'T ALLOW . . . . .7 EMERGENT DELIVERY. 8	→32
31	What did you think the affordability of cost for hospital delivery based on your economic status?	CHEAPEST. . . . . 1 CHEAP. . . . . .2 MIDDLE. . . . . 3 EXPENSIVE. . . . . 4 MOST EXPENSIVE. 5	
32	What was the manner of childbirth?	NATURAL DELIVERY. . . . . .1 VIGINA INSTRUMENTAL DELIVERY. . . . . .2 CAESAREAN SECTION. 3	
33	Was it clean delivery? JUDGE ACCORDING TO FOUR CLEANS	YES. . . . . 1 NO. 2	

34	Who delivered the baby?	MEDICAL STAFF . . . . . .1 VILLAGE DOCTOR . . . . 2 MIDWIFE . . . . . 3 PRIVATE CLINIC DOCTOR. . . 4 OTHER PERSONS 5	
35	Did health workers visit you at home within one month after childbirth?	YES, ≥3 TIMES. . . . . 1 YES, 1～2 TIMES. . . . . .2 NO. 3	
36	What was the birth outcome?	STILL BIRTH. . . . . 1 LIVE BIRTH. . . . . 2 DEATH WITHIN 7 DAYS AFTER BIRTH. 3	→END →38
37	Had the baby died from tetanus?	YES. . . . . 1 NO. 2	
38	What was the birth weight of your baby?	＜2500g. . . . . 1 2500～4000g. . . . . 2 ＞4000g. 3	
39	Had the baby infected neonatal tetanus?	YES. . . . . 1 NO. 2	

Questionnaire 3--Health care status of children under seven

[NAME OF COUNTY/CITY] _____

[NAME OF TOWNSHIP] _____

[NAME OF VILLAGE] _____

IDENTIFICATION	
HOUSEHOLD CODE _____	□□□□□□
RESPONDENT CODE _____	□□□□□
INTERVIEWER CODE _____	□□□

RESULT OF FINAL VISIT	
RESULT CODES:	□
1 COMPLETED	
2 PARTLY COMPLETED	
3 NO COMPETENT RESPONDENT AT HOME AT TIME OF VISIT	
4 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME	
5 REFUSED	
6 OTHER (PLEASE SPECIFY)_____	

SUPERVISOR	
NAME _____	
DATE _____	
CODE _____	□□□

INFORMED CONSENT

Hello. My name is _____ and I am working with NCWCH. We are conducting a survey that asks about health issues of children under seven during 2006.10.1--2007.9.30. We would very much appreciate your participation in this survey. This information will help the government to plan health services. The survey usually takes about 20 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Participation in this survey is voluntary, and if we should come to any question you don't want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time. However, we hope that you would participate in this survey since your views are important.

At this time, do you want to ask me anything about the survey?

May I begin the interview now?

Signature of interviewer: _____ Date: _____

RESPONDENT AGREES TO BE INTERVIEWED . . .1 RESPONDENT DOES NOT AGREE TO BE INTERVIEWED. . 2→ END

↓

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
01	Are you local resident?	YES. . . . . .1 NO, MIGRATION MORE THAN ONE YEAR. . . . . .2 NO, MIGRATION LESS THAN ONE YEAR. 3	
02	Did this child in your plan?	YES. . . . . .1 NO. 2	
03	What's the birth sequence of this child in your family?	SEQUENCE. . . . . □□	
04	What's the relationship between you and child?	MOTHER. . . . . 1 FATHER. . . . . .2 GRANDMA. . . . . 3 GRANDPA. . . . . 4 OTHERS. 5	
05	Gender of the child	MALE . . . . . 1 FEMALE 2	
06	Ethnicity of the child	HAN MAJORITY. . . . . 1 ETHNIC MINORITIES. 2	
07	Current marital status of child parents	CURRENTLY MARRIED . . . . . 1 CURRENTLY LIVING WITH A MAN . . . . . 2 WIDOWED . . . . . 3 DIVORCED . . . . . 4 SEPARATED . . . . . 5 LIVED WITH A MAN . . . . . .6 NEVER MARRIED. 7	
08	What is the highest level of school mother attended?	NONE . . . . . 1 PRIMARY . . . . . 2 SECONDARY . . . .3 HIGH SCHOOL . . . . . 4 COLLEGE AND HIGHER. . . . . 5 DON'T KNOW 9	
09	What is the highest level of school father attended?	NONE . . . . . 1 PRIMARY . . . . . 2 SECONDARY . . . .3 HIGH SCHOOL . . . . . 4 COLLEGE AND HIGHER. . . . . 5 DON'T KNOW 9	
10	Which level of annual family income per capita in average? (RMB Yuan)	＜1000. . . . . 1 1000～1999. . . . . 2 2000～3999. . . . . 3 4000～8000. . . . . 4 ＞8000. 5	

11	Does your household have: A radio? An electric fan? A color television? A refrigerator? A washing machine? An air conditioner? A clock? A mobile telephone? A non-mobile telephone? A table? A cabinet? A sofa? A bicycle? A motorcycle or animal-drawn cart? A car or truck?	YES NO RADIO. . . . . 1 2 FAN. . . . .1 2 TELEVISION . . . . . .1 2 REFRIGERATOR. . . . . .1 2 WASHING MACHINE. . . . . .1 2 AIR CONDITIONER. . . . . 1 2 CLOCK. . . . .1 2 MOBILE TELEPHONE . . . .. . 1 2 NON-MOBILE TELEPHONE .1 2 TABLE. . . . . .1 2 CABINET. . . . . .1 2 SOFA. . . . . ..1 2 BICYCLE. . . . . .1 2 MOTORCYCLE. . . . . .1 2 CAR/TRUCK. 1 2	
12	Who in your family usually has the final say on the following decisions: Whether to have another child? Whether or not to receive immunization for child? Whether or not to receive health examination regularly for child? What to do if a child falls sick? How children should be disciplined? Whether or not to go to kindergarten? Any decisions about children's schooling?	FATHER =1 MOTHER =2 FATHER & MOTHER JOINTLY =3 FATHER'S PARENTS =4 MOTHER'S PARENTS =5 PARENTS & SOMEONE ELSE JOINTLY =6 DECISION NOT MADE /NOT APPLICABLE =7 ANOTHER CHILD. . . . . 1 2 3 4 5 6 7 IMMUNIZATION . . . . . .1 2 3 4 5 6 7 HEALTH EXAM . . . . . .1 2 3 4 5 6 7 MEDICAL. . . . . .1 2 3 4 5 6 7 DISCIPLINE. . . . . .1 2 3 4 5 6 7 KINDERGARTEN. . . . . 1 2 3 4 5 6 7 SCHOOL 1 2 3 4 5 6 7	
13	Now I would like to get your opinion on some aspects of child health care. Please tell me if you agree or disagree with each statement: Child should accept health examination regularly. Child should immune vaccines to prevent diseases. Breast milk is the best food for child in the first six	DIS AGREE AGREE DK HEALTH EXAM 1 2 3 IMMUNIZATION 1 2 3 BREAST MILK 1 2 3	

	months. Height and weight of child should be monitored by health workers to ensure good growth development. Caregivers should seek medical treatment timely if child falls sick. It is better to send a son to school than it is to send a daughter.	GD MONITOR 1 2 3 MEDICAL 1 2 3 BETTER TO SCHOOL SON 1 2 3	
14	What was birth date of the child?	DAY . . . . . .□□ DON'T KNOW DAY . . . . . 99 MONTH . . . . . .□□ DON'T KNOW MONTH . . . . . 99 YEAR . . . . . □□□□ DON'T KNOW YEAR 9999	
15	How old was the child at his/her last birthday? AGE IN COMPLETED YEARS COMPARE AND CORRECT 03 IF INCONSISTENT.	AGE IN COMPLETED YEARS .□□ ＜1 YEAR. . . . . .1 1～3 YEARS. . . . . .2 4～5 YEARS. . . . . .3 6～7 YEARS. 4	 →20 →20 →20
16	What was the birth weight of child?	＜2500g. . . . . 1 2500～4000g. . . . . 2 ＞4000g. 3	
17	How many gestation weeks when child was born?	GESTATION WEEKS. . . . . .□□	
18	Was child breastfed? IN THE LAST 24 HOURS	YES. . . . . .1 NO. . . . . 2 DON'T KNOW. 9	
19	Was child exclusively breastfed for the first six months after birth? IN THE LAST 24 HOURS	YES. . . . . .1 NO. . . . . 2 DON'T KNOW. 9	
20	Did you establish a child health care card/book in health facilities when child was born?	YES. . . . . 1 NO. 2	
21	How many times of health examination child received for the first year after birth? How many times of health examination child received for the second year after birth? How many times of health examination child received for the third year after birth? How many times of health examination child received each year after three?	1ST YEAR. . . . . □□ 2ND YEAR. . . . . ..□□ 3RD YEAR. . . . . ..□□ 4～7 YEARS. . . . . □□	
22	Did you have an immunization card? IF YES: IF POSSIBLE, ASK TO SEE THE CARD.	YES . . . . . 1 NO, CARD LOST . . . . . 2 NO CARD USED 3	
23	How old was the mother when child was born?	AGE IN COMPLETED YEARS. □□	
24	Where the child was born?	HOSPITAL AT PROVINCIAL (PREFECTURE) LEVEL 1	

		HOSPITAL AT COUNTY LEVEL. . . . . 2 TOWNSHIP HOSPITAL. . . . . .3 VILLAGE STATION. . . . . .4 HOME. . . . . 5 EN ROUTE. . . . . 6 PRIVATE CLINICS. 7	
25	Did the child live together with parents?	YES, WITH PARENTS. . . . . .1 YES, WITH MOTHER ONLY. . . 2 YES, WITH FATHER ONLY. . . . 3 NO. 4	
26	Did you seek care or treatment for child illness in medical institutions?	YES. . . . . .1 NO. . . . . 2 DON'T KNOW. 9	→END →27 →END
27	Why you didn't seek care or treatment for child illness in medical institutions?	NO MONEY. . . . . .1 INCONVENIENT TRAFFIC. . . . .2 THINK UNNECCESSARY. . . . . 3 DON'T BELIEVE MEDICAL INSTITUTIONS. . . . . 4 UNPLANNED PREGNANCY. . . .5 FAMILIES DON'T ALLOW 6	

ANNEX 3. Questionnaires (Chinese version)

Questionnaire 1--孕产妇和 7 岁以下儿童筛查家庭问卷

调查对象：全村所有的家庭

[县/市名称] _____[乡镇名称] _____[村名称]_____

标识码	
家庭编码 _____	□□□□□
入户调查者编码 _____	□□□

最后一次入户调查结果	
结果编码： 1 完成问卷 2 部分完成 3 入户时能应答者不在家 4 一段时间内全家都外出 5 拒绝调查 6 其他 (请详细说明)_____	□

监督	
姓名 _____ 日期 _____ 编码 _____	□□□

调查时间段：2007年10月1日—2008年9月30日

序号	问题	分类编码	答案	跳问
01	您家里有年龄在 15-49 岁之间的女人吗？	有. . . . . 1 没有. 2	□	→08
02	共有几位 15-49 岁的女人？	数量. . . . . □□		
03	您家里有新婚的女人吗？	有. . . . . 1 没有. 2	□	→06
04	共有几位新婚的女人？	数量. . . . . □□		
05	有几位新婚的女人做过婚前检查？	婚检. . . . . □□		
06	您家里有怀孕或/和分娩的妇女吗？	有. . . . . 1 没有. 2	□	→08

07	共有几位怀孕或/和分娩的妇女？	数量.....□□		
08	您家里有育龄妇女死亡吗？	有.....1 没有.....2	□	→12
09	育龄妇女死亡的人数	数量.....□□		
10	她/她们是死于怀孕或分娩吗？	是.....1 否.....2	□	→12
11	死于怀孕或分娩的人数 ***为每例孕产妇死亡填写孕产妇死亡报告卡和调查附卷***	数量.....□□		
12	您家里有 7 岁以下的孩子吗？ **（2000 年 10 月 2 日—2008 年 9 月 30 日之间出生的孩子）**	有.....1 没有.....2	□	→22
13	共有几个 7 岁以下的孩子？	数量.....□□		
14	您家里有 5 岁以下的孩子吗？ **（2002 年 10 月 2 日—2008 年 9 月 30 日之间出生的孩子）**	有.....1 没有.....2	□	→22
15	共有几个 5 岁以下的孩子？	数量.....□□		
16	您家里有 3 岁以下的孩子吗？ **（2004 年 10 月 2 日—2008 年 9 月 30 日之间出生的孩子）**	有.....1 没有.....2	□	→22
17	共有几个 3 岁以下的孩子？	数量.....□□		
18	您家里有 1 岁以下的孩子吗？ **（2006 年 10 月 2 日—2008 年 9 月 30 日之间出生的孩子）**	有.....1 没有.....2	□	→22
19	共有几个 1 岁以下的孩子？	数量.....□□		
20	您家里有新出生的孩子吗？ **（2007 年 9 月 4 日—2008 年 9 月 30 日之间出生的孩子）**	有.....1 没有.....2	□	→22
21	共有几个新出生的孩子？	数量.....□□		
22	您家里有 5 岁以下儿童死亡吗？	有.....1 没有.....2	□	→结束
23	5 岁以下儿童死亡的人数 ***为每例儿童死亡填写儿童死亡报告卡***	0～28 天 .....□□ 0～1 岁.....□□ 1～3 岁.....□□ 4～5 岁.....□□		

Questionnaire 2--孕产妇保健服务利用情况调查问卷

调查对象：2007 年 10 月 1 日—2008 年 9 月 30 日怀孕和分娩的妇女

[县/市名称] _____[乡镇名称] _____[村名称]_____

标识码	
家庭编码 _____	□□□□□
应答者编码 _____	□□□□□
入户调查者编码 _____	□□□

最后一次入户调查结果	
结果编码： 1 完成问卷 2 部分完成 3 入户时能应答者不在家 4 一段时间内全家都外出 5 拒绝调查 6 其他 (请详细说明)_____	□

监督	
姓名 _____	
日期 _____	
编码 _____	□□□

知情同意

您好！我是_____。我们正在开展中国疾病预防控制中心妇幼保健中心的一项调查，了解在2007年10月1日—2008年9月30日期间怀孕和分娩妇女的保健服务利用情况。我们非常感谢您能参与此次调查。您提供的信息将有助于卫生部门规划妇幼保健服务。这个调查大约会占用您15分钟的时间。您提供的所有信息我们都将严格保密，不会泄露给其他任何人。

参与调查是自愿的，如果有您不愿意回答的问题请尽管告诉我，我们可以继续下一个问题，或者您可以随时终止参与调查。无论如何，我们都希望您能参与此次调查，因为您的观点对于我们很重要。

对于这个调查您还有什么问题吗？

现在，我们可以开始了吗？

被调查者签名：_____ 日期：2008年 月 日

被调查者同意参与调查 . . .1 ↓　　被调查者不同意参与调查. . . 2→ 结束

调查时间段：2007 年 10 月 1 日—2008 年 9 月 30 日

序号	问题	分类编码	答案	跳问
01	您是本地居民吗？	是.....1 不是，到这里一年多了.....2 不是，到这里不到一年.....3	□	
02	您的出生日期？**（出生年月）** **不知道月份填 99** **不知道年份填 9999**	月份 .....□□ 年份 .....□□□□		
03	您的年龄？**（按周岁填写）** 与问题02核对是否一致。	年龄（周岁）.....□□		
04	民族	汉族.....1 少数民族.....2	□	
05	您的文化程度？	没上过学 .....1 小学 .....2 初中 .....3 高中 .....4 大专及以上.....5 不知道 9	□	
06	婚姻状况？	已婚 .....1 寡居.....2 离婚.....3 分居.....4 未婚同居.....5 未婚.....6	□	**→08** **→08** **→08**
07	您丈夫的文化程度？	没上过学 .....1 小学 .....2 初中 .....3 高中 .....4 大专及以上.....5 不知道 9	□	
08	您居住地的地理位置？	平原.....1 山区.....2 其他地区.....3	□	
09	从您家坐车到最近的医院大约需要多长时间？	不到10分钟 .....1 10分钟～半小时 .....2 半小时～1小时 .....3 1～2小时 .....4 2～4小时 .....5 超过4小时 .....6 不知道 9	□	
10	您的家庭年人均收入大概有多少？（元）	＜1000.....1 1000～1999.....2	□	

		2000～3999. . . . . .3 4000～8000. . . . . .4 ＞8000. 5		
11	您家里有下面那些物品：	有 没有		
	收音机？	收音机. 1 2	☐	
	电风扇？	风扇. 1 2	☐	
	彩色电视机？	彩电. 1 2	☐	
	电冰箱？	冰箱. 1 2	☐	
	洗衣机？	洗衣机. 1 2	☐	
	空调？	空调. 1 2	☐	
	时钟？	时钟. 1 2	☐	
	手机？	手机. 1 2	☐	
	电话？	电话. 1 2	☐	
	餐桌？	餐桌. 1 2	☐	
	衣柜？	衣柜. 1 2	☐	
	沙发？	沙发. 1 2	☐	
	自行车？	自行车. 1 2	☐	
	摩托车或者畜力车？	摩托车. 1 2	☐	
	汽车或者货车？	汽车. 1 2	☐	
12	在您家里通常谁对以下事情做出决定：	**孕产妇本人 =1** **丈夫 =2** **夫妻共同决定 =3** **女方父母 =4** **男方父母 =5** **女方和其他人共同决定 =6** **没人做决定 =7**		
	是否采取避孕措施？	避孕措施. . . .1 2 3 4 5 6 7	☐	
	是否到医院做产前检查？	产前检查. . . .1 2 3 4 5 6 7	☐	
	是否到医院生孩子？	住院分娩. . . .1 2 3 4 5 6 7	☐	
	是否接受医生到家里做产后访视？	产后访视. . . .1 2 3 4 5 6 7	☐	
	谁决定日常生活费用开支？	生活开支. . . .1 2 3 4 5 6 7	☐	
	谁决定医疗保健费用开支？	医疗费用. . . .1 2 3 4 5 6 7	☐	
13	如果需要，您自己能做主购买以下物品吗？	能 不能 不买		
	蔬菜或水果？	蔬菜/水果. 1 2 3	☐	
	牛奶或鸡蛋？	牛奶/鸡蛋. 1 2 3	☐	

	自己的衣服？	衣服. 1 2 3	☐	
	为自己买需要的各种药？	药品. 1 2 3	☐	
	保健品，如叶酸、钙片、维生素等？	保健品. 1 2 3	☐	
14	现在我希望了解您对于家庭生活的一些观点。 请告诉我您是否同意以下的说法：	同意 不同意 不知道		
	家庭中重要的事情应该只能由男人做决定。	男人做决定. 1 2 3	☐	
	如果妻子在外面工作，丈夫应该帮助妻子做家务。	丈夫做家务. 1 2 3	☐	
	如果已婚妇女想出去工作，家庭应该允许。	女人工作. 1 2 3	☐	
	妻子与丈夫的观点发生分歧时，妻子有权发表自己的意见。	妻子发表意见. . .1 2 3	☐	
	为了维护家庭完整，妻子应该忍受丈夫的打骂。	妻子忍受打骂. . .1 2 3	☐	
	男孩应该优先得到受教育的机会。	孩子教育. 1 2 3	☐	
15	您还记得您的生育史吗？ **（不记得填 99）**	孕次. . . . . ☐☐ 产次. . . . . ☐☐ 人工流产、引产次. . . . . ☐☐		
16	您怀孕时是否在医院建立孕产期保健册/卡？	是. . . . . .1 否. 2	☐	**→18**
17	您还记得建立孕产期保健册/卡时怀孕多少周了吗？**（不记得填 99）**	建册时孕周. . . . . ☐☐		
18	您是高危妊娠吗？	是. . . . . .1 否. 2	☐	
19	您做过产前检查吗？	是. . . . . .1 否. 2	☐	**→21**
20	您为什么没做产前检查？	没钱. . . . . .1 没时间. . . . . .2 交通不方便. . . . . .3 认为没必要. . . . . .4 不知道要做. . . . . .5 不相信医院. . . . . .6 计划外妊娠. . . . . .7 家里人不允许. 8	☐	**→26**
21	您有产前检查记录卡/册吗？ **如果回答有，可能的话，要求看一下卡/册，便于核对问题 23～25。**	有. . . . . .1 有，在医疗机构保存. . . . . .2 没有用过. 3	☐	

22	您最经常在哪里做产前检查？	省（地、市）级医院.....1 区县级医院.....2 街道（乡镇）卫生院.....3 村卫生室.....4 私人诊所.....5 家中.....6	□	
23	您总共做了几次产前检查？	1 次.....1 2～3 次.....2 4～5 次.....3 6～7 次.....4 ≥8 次.....5	□	
24	在产前检查中，医生给您做过以下哪些检查：	是 否 不知道		
	量血压	血压.....1 2 3	□	
	称体重	体重.....1 2 3	□	
	摸胎位	胎位.....1 2 3	□	
	测宫高	宫高.....1 2 3	□	
	听胎心	胎心.....1 2 3	□	
	做B超	B 超.....1 2 3	□	
	乳房检查	乳房.....1 2 3	□	
	阴道/会阴检查	阴道.....1 2 3	□	
	血常规	血.....1 2 3	□	
	尿常规	尿.....1 2 3	□	
	梅毒检测	梅毒.....1 2 3	□	
	HIV检测	HIV.....1 2 3	□	
25	根据您的经济状况，您认为产前检查的花费是否合适？	非常便宜.....1 便宜.....2 适中.....3 贵.....4 非常贵.....5	□	
26	怀孕的结局如何？	好.....1 自然流产.....2 人工流产.....3	□	
孕妇调查到此结束，产妇继续				
27	您在哪里分娩的？	省（地、市）级医院.....1 区县级医院.....2 街道（乡镇）卫生院.....3 村卫生室.....4 家中.....5 途中.....6	□	**→29** **→29** **→29**

		私人诊所.....7		
28	您为什么不到医院去生孩子？	没钱.....1 交通不方便.....2 认为没必要.....3 不知道.....4 不相信医院.....5 计划外妊娠.....6 家里人不允许.....7 急产.....8	□	**→30**
29	根据您的经济状况，您认为住院分娩的花费是否合适？	非常便宜.....1 便宜.....2 适中.....3 贵.....4 非常贵.....5	□	
30	分娩的方式?	自然分娩.....1 阴道助产.....2 剖腹产.....3	□	
31	是新法接生吗？ **（根据“四个清洁”判断）**	是.....1 否.....2	□	
32	是谁为您接生的？	医院医生 .....1 村医 .....2 接生员 .....3 私人诊所医生.....4 其他人 5	□	
33	在您产后一个月内有医生到您家里来过吗？	有，≥3 次.....1 有，1～2 次.....2 没有.....3	□	
34	分娩**孩子**的结局如何？	死产.....1 活产.....2 出生后 7 天内死亡.....3	□	**→结束** **→36**
35	孩子是死于破伤风吗？	是.....1 否.....2 不知道 9	□	
36	孩子出生时的体重是多少？	＜2500g.....1 2500～4000g.....2 ＞4000g.....3 不知道 9	□	
37	孩子感染过新生儿破伤风吗？	是.....1 否.....2 不知道 9	□	

Questionnaire 3--7 岁以下儿童保健服务利用情况调查问卷

调查对象：7 岁以下儿童（2000 年 10 月 2 日—2008 年 9 月 30 日出生的儿童）看护人

[县/市名称] _____[乡镇名称] _____[村名称]_____

标识码	
家庭编码 _____	□□□□□
儿童看护人编码 _____	□□□□□
入户调查者编码 _____	□□□

最后一次入户调查结果	
结果编码： 1 完成问卷 2 部分完成 3 入户时儿童看护人不在家 4 一段时间内全家都外出 5 拒绝调查 6 其他 (请详细说明)_____	□

监督	
姓名 _____	
日期 _____	
编码 _____	□□□

知情同意

您好！我是_____。我们正在开展中国疾病预防控制中心妇幼保健中心的一项调查，了解在2007年10月1日—2008年9月30日期间不满7岁儿童的保健服务利用情况（***2000年10月2日—2008年9月30日之间出生的孩子***）。我们非常感谢您能参与此次调查。您提供的信息将有助于卫生部门规划妇幼保健服务。这个调查大约会占用您10分钟的时间。您提供的所有信息我们都将严格保密，不会泄露给其他任何人。

参与调查是自愿的，如果有您不愿意回答的问题请尽管告诉我，我们可以继续下一个问题，或者您可以随时终止参与调查。无论如何，我们都希望您能参与此次调查，因为您的观点对于我们很重要。

对于这个调查您还有什么问题吗？

现在，我们可以开始了吗？

被调查者签名：_____ 日期：2008年 月 日

被调查者同意参与调查 . . .1 ↓ 被调查者不同意参与调查. . . 2→ 结束

调查时间段：2007 年 10 月 1 日—2008 年 9 月 30 日

序号	问题	分类编码	答案	跳问
01	您是本地居民吗？	是.....1 不是，到这里一年多了.....2 不是，到这里不到一年.....3	□	
02	这个孩子上户口了吗?	是.....1 否.....2	□	
03	这个孩子在家里排行第几?	排行.....□□		
04	您与这个孩子是什么关系?	妈妈.....1 爸爸.....2 奶奶/姥姥.....3 爷爷/姥爷.....4 其他.....5	□	
05	孩子的性别	男.....1 女.....2	□	
06	孩子的民族	汉族.....1 少数民族.....2	□	
07	孩子父母的婚姻状况?	已婚.....1 离婚.....2 父亲或母亲过世.....3 未婚同居.....4 未婚.....5	□	
08	孩子母亲的文化程度?	没上过学 .....1 小学 .....2 初中 .....3 高中 .....4 大专及以上.....5 不知道 9	□	
09	孩子父亲的文化程度?	没上过学 .....1 小学 .....2 初中 .....3 高中 .....4 大专及以上.....5 不知道 9	□	
10	您的家庭年人均收入大概有多少？（元）	＜1000.....1 1000～1999.....2 2000～3999.....3 4000～8000.....4 ＞8000.....5	□	
11	您家里有下面那些物品： 收音机?	有 没有 收音机.....1 2	□	

	电风扇？	风扇. 1 2	☐	
	彩色电视机？	彩电. 1 2	☐	
	电冰箱？	冰箱. 1 2	☐	
	洗衣机？	洗衣机. 1 2	☐	
	空调？	空调. 1 2	☐	
	时钟？	时钟. 1 2	☐	
	手机？	手机. 1 2	☐	
	电话？	电话. 1 2	☐	
	餐桌？	桌子. 1 2	☐	
	衣柜？	衣柜. 1 2	☐	
	沙发？	沙发. 1 2	☐	
	自行车？	自行车. 1 2	☐	
	摩托车或者畜力车？	摩托车. 1 2	☐	
	汽车或者货车？	汽车. 1 2	☐	
12	在您家里通常谁对以下事情做出决定：	**父亲 =1** **母亲 =2** **父母共同决定 =3** **爷爷奶奶 =4** **外公外婆 =5** **父母和其他人共同决定 =6** **没人做决定 =7**		
	是否再生一个孩子？	再生孩子. . . .1 2 3 4 5 6 7	☐	
	孩子是否接受免疫接种？	免疫接种. . . .1 2 3 4 5 6 7	☐	
	孩子是否做体检？	体检. 1 2 3 4 5 6 7	☐	
	孩子生病时如何处理？	医疗. 1 2 3 4 5 6 7	☐	
	孩子怎样喂养？	喂养. 1 2 3 4 5 6 7	☐	
	孩子怎样教育？	教育. 1 2 3 4 5 6 7	☐	
13	现在我希望了解您对于儿童保健的一些观点。请告诉我您是否同意以下的说法：	同意 不同意 不知道		
	孩子应该接受定期体检。	体检. 1 2 3	☐	
	孩子应该接种疫苗来预防疾病。	计免. 1 2 3	☐	
	母乳是孩子 6 个月内最好的食物。	母乳. 1 2 3	☐	
	孩子的身高和体重应该由医生进行监测以保证孩子生长发育正常。	监测. 1 2 3	☐	
	孩子生病时看护人应及时带孩子去看病。	看病. 1 2 3	☐	

	男孩应该优先接受医疗和保健。	性别. . . . . 1　　2　　3	□	
14	孩子的出生日期？**（出生年月日）** **不知道日子或月份填99** **不知道年份填9999**	日子 . . . . . □□ 月份 . . . . . □□ 年份 . . . . . □□□□		
15	孩子的年龄？**（按周岁填写）** 与问题14核对看是否一致。	年龄（周岁）. . . . . □岁□□月 ＜6 个月. . . . . 1 6 个月～1 岁. . . . . 2 1～3 岁. . . . . 3 3～5 岁. . . . . 4 5～7 岁. 5		 **→18** **→20** **→20** **→20**
16	孩子是母乳喂养吗？ **通过询问过去 24 小时内进食情况确定**	是. . . . . 1 不是. 2	□	 **→18**
17	孩子是纯母乳喂养吗？ **通过询问过去 24 小时内进食情况确定**	是. . . . . 1 不是. 2	□	
18	孩子出生时的重量？	＜2500g. . . . . 1 2500～4000g. . . . . 2 ＞4000g. . . . . 3 不知道 9	□	
19	孩子是在怀孕多少周出生的？**不知道填99**	孕周. . . . . □□		
20	孩子出生时在医疗保健机构建立儿童保健卡/册了吗？	是. . . . . 1 否. 2	□	
21	孩子出生后第一年内做过几次体检？ 孩子出生后第二年内做过几次体检？ 孩子出生后第三年内做过几次体检？ 孩子 3 岁后每年做过几次体检？	第一年. . . . . □□ 第二年. . . . . □□ 第三年. . . . . □□ 4～7 岁. . . . . □□		
22	孩子有免疫接种卡吗？	有. . . . . 1 用过，但卡丢了 . . . . . 2 没有用过. 3	□	
23	孩子出生时妈妈的年龄？**不知道填 99**	年龄（周岁）. . . . . □□		
24	孩子的出生地点？	省（地、市）级医院. . . . . 1 区县级医院. . . . . 2 街道（乡镇）卫生院. . . . . 3 村卫生室. . . . . 4 家中. . . . . 5 途中. . . . . 6 私人诊所. 7	□	
25	孩子现在是和父母住在一起吗？	是，和父母. . . . . 1 是，只和母亲. . . . . 2 是，只和父亲. . . . . 3 不是. 4	□	

26	孩子生病时您会带他/她去医院看病吗？	会. . . . . 1 不会. 2	□	**→结束 →27**
27	您不带孩子去医院看病的原因？	没钱. . . . . 1 交通不方便. . . . . 2 认为没必要. . . . . 3 不相信医院. . . . . 4 计划外妊娠. . . . . 5 家里人不允许. 6	□	